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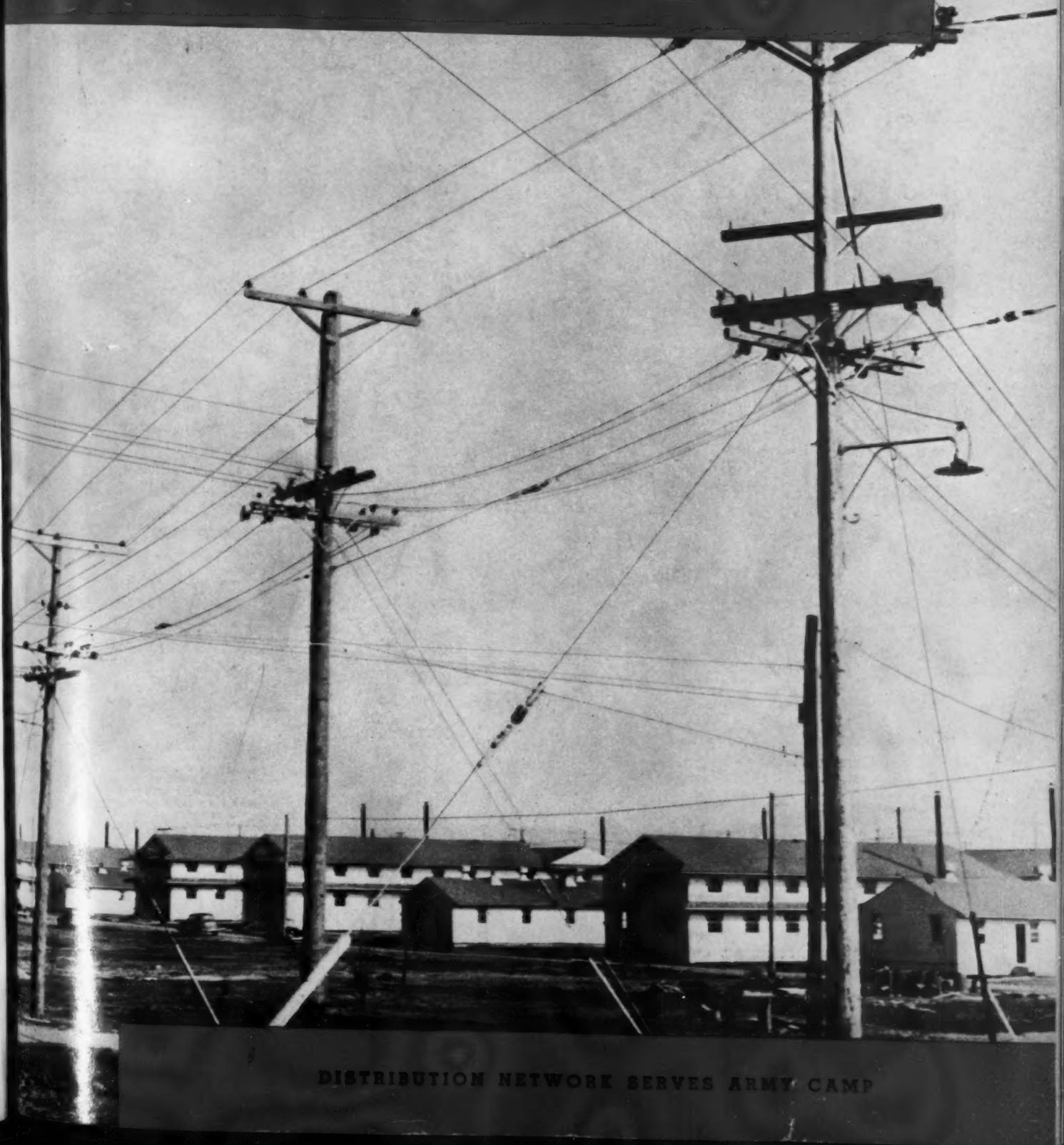
SEPTEMBER 20, 1941



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September 20, 1941

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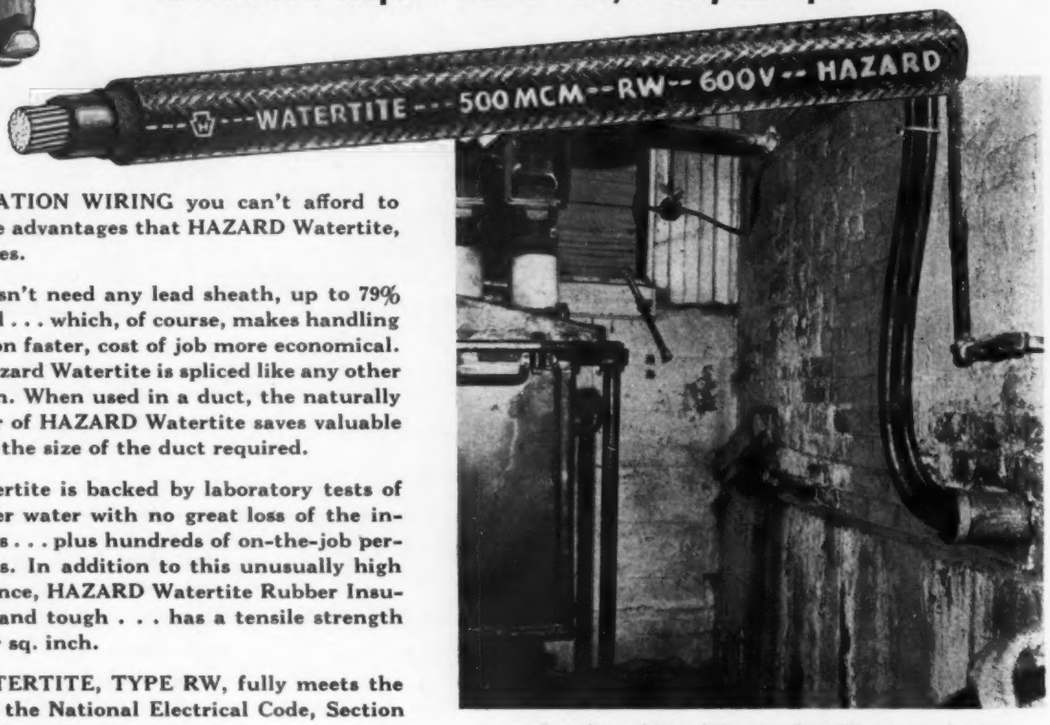
HAZARD WATERTITE TYPE RW—for use instead of lead-sheathed wire in wet locations...eliminates lead wipes...makes installations simple...saves time, money and space.



Typical use of Hazard Watertite, Type RW, in a wet location. 3 1/C 500,000 CM Hazard Watertite, 220 volts, used from transformer back through building wall and underground in pipe to next building in manufacturing plant.

FOR WET LOCATION WIRING you can't afford to overlook all these advantages that HAZARD Watertite, Type RW, provides.

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HAZARD Watertite is backed by laboratory tests of seven years under water with no great loss of the insulating qualities . . . plus hundreds of on-the-job performance records. In addition to this unusually high moisture-resistance, HAZARD Watertite Rubber Insulation is strong and tough . . . has a tensile strength of over a ton per sq. inch.

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Game Fish

From gloom comes pessimism. From pessimism comes defeatism—and then you're licked. A utility executive asking us to speak this fall at a state meeting said "give us something to cheer us up. There is too much pessimism."

If this man is right, then there are a great many utility people, at least in his neck of the woods, who are next door to getting the defeatist attitude.

There would be some justification for that attitude on the part of executives who are trying to retain some part of the functions of management were it not for the fact that they have in their hands not only safekeeping of the investors' money but the destiny of their employees.

Federal and state regulation, taxes, labor trouble, mounting costs, need for new investment under financing restrictions, worry about keeping this investment employed after the emergency, loss of employees, priorities and now the growing difficulty in getting load-building devices are enough to drive a saint to distraction, but not enough to get a fighter down—not enough to defeat a man who believes in the business.

Game fish swim up stream. They battle the raging waters and scorn the warmth of the lower shallows. And in that struggle they become strong. There is no barrier too great to discourage them at least from trying to get over.

And what's up stream? Their future.

Less than a generation ago the utility industry and those who supplied it with materials and equipment were going at a terrific pace. There was no limit then to the future of electricity. Has anything happened in the meantime to change that?

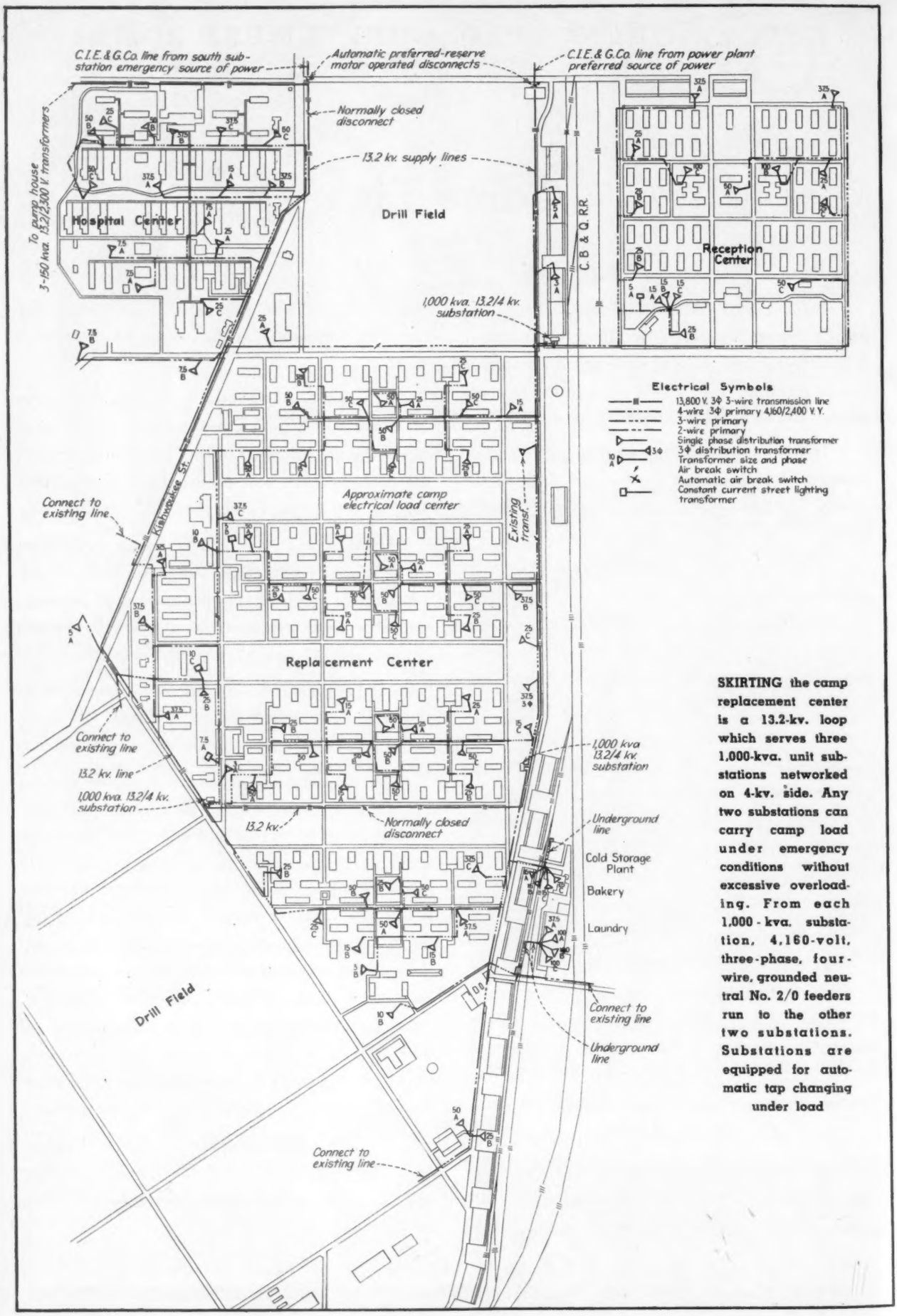
The energy generated in central stations in 1929 was 96 billion kilowatt-hours. This year it will be close to 170 billions, and next year in all probability it will exceed twice that of that famous peace-time boom year.

During this emergency every industrial management will find its scope limited. In all probability much of this usurpation of management functions will continue afterward. In this respect utilities will have plenty of company.

But the big limitation of today, on the creation and satisfaction of the demands of peace consumption, will be lifted when the emergency is over. Then what?

Will we leave all this defense-created production capacity to rust and fall apart? In every industry the instinct of self-preservation will cause people to have new visions of markets. Every one of these people will be working for the electrical industry, for electricity in peace, as in war, is the country's number one raw material. Just as the industry has never ceased to expand its output for more than a short space of time there is no reason to believe it will do different this time. Yet to see this one must have the confidence of a trout swimming up stream.

Only we must remember that the trout would never get up there if he got discouraged over the results of his unsuccessful jumps to get over the falls.



SKIRTING the camp replacement center is a 13.2-kv. loop which serves three 1,000-kva. unit substations networked on 4-kv. side. Any two substations can carry camp load under emergency conditions without excessive overloading. From each 1,000-kva. substation, 4,160-volt, three-phase, four-wire, grounded neutral No. 2/0 feeders run to the other two substations. Substations are equipped for automatic tap changing under load

Reliability Dictates Network for Camp Grant Distribution

Duplicate 13.2-kv. lines with automatic preferred-reserve switching serve three unit substations, supplying 4-kv. network — Transmission to load centers at 13.2-kv. and network distribution replace obsolete 1917 radial system

BY HYPOTHESIS, a military camp is not a civilian residential area. Problems of distribution design for Camp Grant—a 13,000-14,000-man cantonment,* located outside Rockford, Ill., might therefore, be expected to be different. The new camp area is small—it occupies only about 300 acres of the 3,200 acres in the military reservation—population density is high, life expectancy of the camp is limited, yet provisions for rapid, foolproof expansion to handle double or triple the original number of men is not an inconsiderable possibility. Service continuity, in event of storm, equipment failure or sabotage, is, if anything, more essential than in civilian areas.

Essentially the system evolved to meet these needs is built around a 13.2-kv. line that loops through the camp to form a huge U, the two arms of which are connected to separate 13.2-kv. utility company lines through motor-operated, air-break switches arranged for automatic preferred-reserve operation. While only one line normally supplies the loop at a time, both lines can be closed in on the loop, if desired.

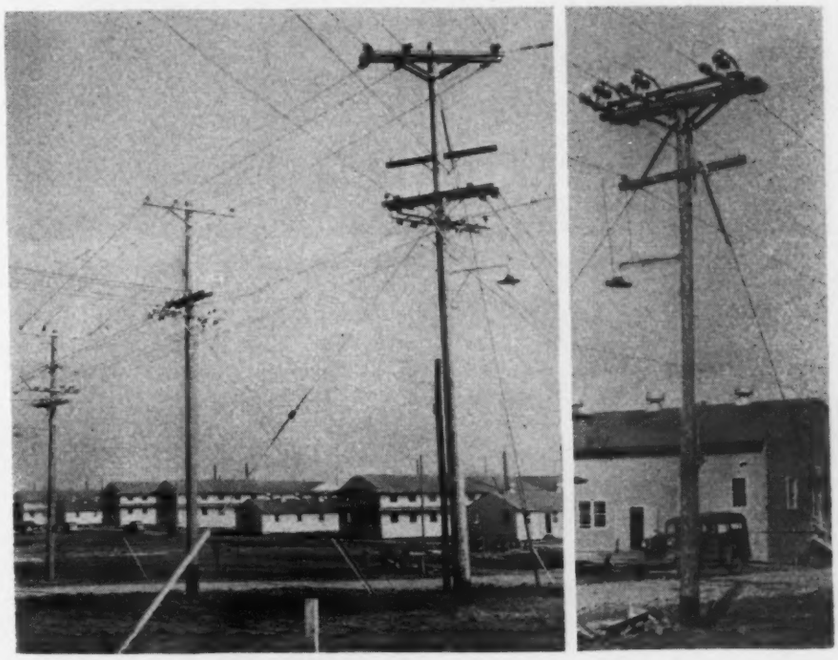
Three 1,000-kva., 13.2-kv. General Electric unit type substations are spotted along the loop. The substations are networked, by connecting each substation to the two others, by three-phase, 4,160-volt, four-wire, grounded neutral No. 2/0 feeders. The network makes it possible to carry the entire camp load with any one substation completely out, should an emergency require.

Connected light and power load in the various camp buildings, of which there are 366, totals about 3,800 kw. for the entire camp. Unlike residential systems, where diversity factor of 40-50 percent might be expected, government specifications require substation capacity and distribution transformer capacity of not less than 80 percent of connected load. This is presumably due to the fact that the messes, and other heavy load sources, are operated in shifts frequently at times when the barrack load would be on.

Demand factor for a camp of this type, again using published government data, is 60 percent. For Camp Grant, therefore, average maximum demand was estimated to be 2,280 kw. Average monthly consumption is 200 times demand, according to War Department construction division data, or about 456,000-kw.-hr. for Camp Grant.

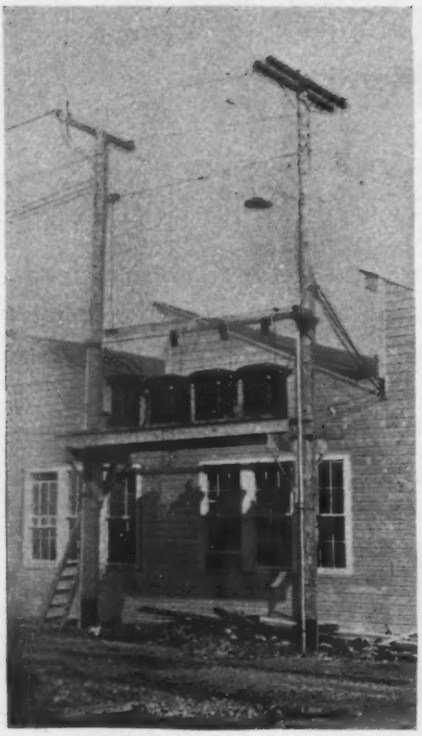
In settling on the Camp Grant distribution system, Holabird & Root, Chicago architects and engineers, considered two principal types of distribution: (1) Radial distribution with feeders from a single substation within the camp, and served by one or more 13.2-kv. lines. (2) Overhead primary network distribution, supplied from three unit-type substations near the camp load center, each capable of being served by two 13.2-kv. lines connected to form a loop.

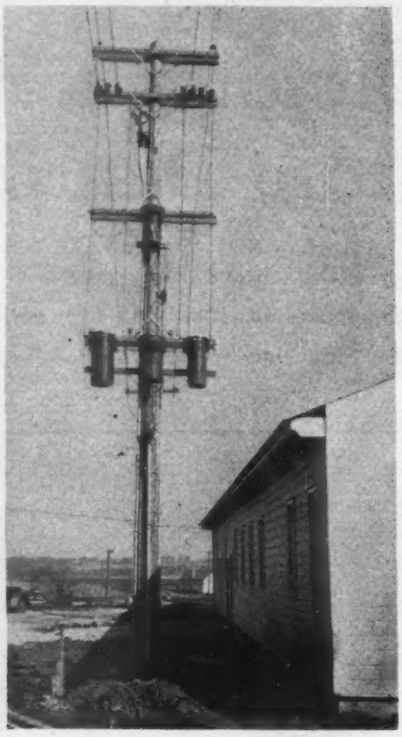
Advantages that finally led to the use of the 13.2-kv. loop and primary



HIGH-VOLTAGE CIRCUIT and 4-kv. network feeders are carried on separate arms of same pole in camp (left). Normally closed disconnect switches sectionalize 13.2-kv. and 4,160-volt circuits so system can be operated radial. This is one of 13.2-kv. sectionalizing switches on loop (right)

* Camp Grant is given over to training of medical troops. It consists of a headquarters, medical department replacement training center, reception center and hospital center.





ON ALMOST-COMPLETED steel transformer platform at the camp laundry building are three 100-kva. power and 37½-kva. lighting transformers. On left-hand pole is pothead for underground street lighting tap, on right pothead for 4-kv. underground distribution tap under railroad tracks (left). Three 15-kva. power and one 7½-kva. lighting transformers serving bakery building are on single pole. A 4-kv., four-wire underground service goes from this pole to 150-kva. vault in adjacent cold storage building (right)

network system can be summarized as follows:

1. The 13.2 kv. "loop" permitted use of a practical automatic preferred-reserve switching arrangement.
2. It enables use of three separate distribution substations, any two capable of carrying the entire camp should one substation become inoperative, thus minimizing the danger of blacking out the entire camp or a large portion of it through failure of the single substation or one of its principal feeders.
3. Reduces operating cost about $20,000 over an assumed five-year life of the camp by using higher voltage to transmit to load centers of the camp and keeping down length of 4-kv. feeders over length required in radial system.
4. Provides continuous, flexible, reliable basic power system for trouble-free operation of essential water pumping, hospital and sewage lift service. These services are switched from one 13.2-kv. line to the other automatically in case of trouble.
5. Provides reliable and practical basic system for expansion for war-time needs.
6. By virtue of advantages (1), (2) and (3) the system has inherent ability to withstand tampering by unauthorized persons to greater degree than a system depending on substation located at the camp boundary and fed by a single incoming line.

While it cost about $4,375 to run the 13.2-kv. loop through the camp and about $5,000 more for three 1,000-kva. unit substations than for a single 3,000-kva. unit substation, the cost of energy losses saved by transmitting energy to load centers at 13.2 kv. and reducing length of 4-kv. feeders was estimated at $342 per month, using army estimates of monthly consumption, or $20,520 over an assumed five-year life of the camp.

Original estimated cost of the camp distribution system, including everything but the automatic motor-operated preferred emergency switching equipment for each 13.2-kv. line, was $208,000. Switching equipment brought this to $211,500. However, the final installed cost of $224,500 was made greater than the estimated, because the rush in building the camp boosted labor costs.

Identical Substations

The three 1,000-kva., 13.2-kv./4,160-volt unit type substations are identical. They tap the 13.2-kv. loop through manually operated disconnect switches and high-voltage fuses. Transformers are provided with automatic equipment for tap changing under load. Transformers are also fitted for use with forced ventilation should load conditions require more capacity. Transformer output passes to the 4,160-volt bus through one of three 600-amp. automatic reclosing oil circuit breakers, the two others of which are feeder breakers providing connection with the other substations.

To isolate any one of the unit substations load is broken on the three breakers and then breaking transformer exciting current with the 13.2-kv. primary disconnect switches. This leaves all camp 4,160-volt feeders "hot" up to the breakers of the station in trouble and permits entire camp load to be carried without interruption by the two other substations normally closed. Sectionalizing disconnect switches in the 4,160-volt main interconnecting feeders provide a means of isolating trouble on subfeeder circuits without losing the entire feeder load. They also permit each individual substation to be operated as the supply for a purely radial system, if desired.

Camp Loads

Because of the essential nature of the service, the three 150-kva., 13.2-/2,300-volt transformer bank serving the camp's 525-hp. water pumping load were connected directly to the 13.2-kv. supply lines on the load side of the preferred-reserve switches. Thus, water pumping will continue as long as either line is in service.

Water pumping is the only motor load in the camp served at a voltage above 220. Other camp motor loads are allocated about as follows (all three phase):

Laundry	—	260 hp.
Bakery	—	50 hp.
Cold storage building	—	200 hp.
Repair shops	—	15 hp.
Stoker load (Laundry and hospital boiler houses)	—	40 hp.
Sewage lift station	—	25 hp.
Theater (ventilation, etc.)	—	40 hp.

The camp has a large number of electric heating devices, such as ranges, deep fat friers and toasters, which with miscellaneous equipment such as ice cream freezers, refrigerators, food mixers, potato peelers, X-ray machines, make up a load of 200-250 kw. Cooking at the camp is mostly done on coal-fired stoves, but there are twelve to fifteen electric ranges for special use. Of the 366 camp buildings, about 255 are heated by forced warm air heaters, each of ⅓ to 2 hp., single phase.

Camp street lighting load is 22.5 kw., which includes a total of 22 10,000-lumen sodium-vapor street lamps operated on series street-lighting circuits.

Regulator and Capacitors Relieve Feeder Voltages

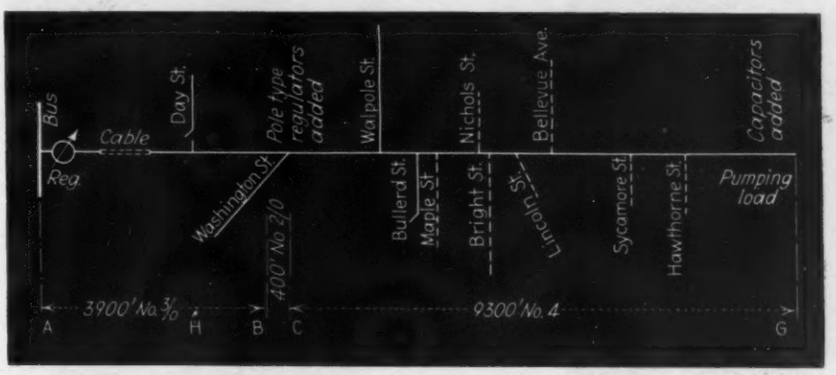
Capacitors and pole-type regulators co-ordinated on Norwood three-phase circuit — Annual return on investment 76 percent

TO IMPROVE the voltage conditions on a 2,400-volt, three-phase, three-wire circuit supplying principally residential load, and pumping station power at the outer end of the line on the Norwood (Mass.) municipal lighting system, an estimate was made of the value of capacitors and pole-type regulators, with the result that 180 kva. of capacitors were installed at the end of the line and a 24-kva. regulator located about one-third of the way out. At the main substation, where energy is purchased from Boston Edison for distribution by the town, two 24-kva. regulators are installed for this circuit. These regulators were found to be overloaded at peaks and the voltage drop on the line, due to load conditions, was about 11 percent.

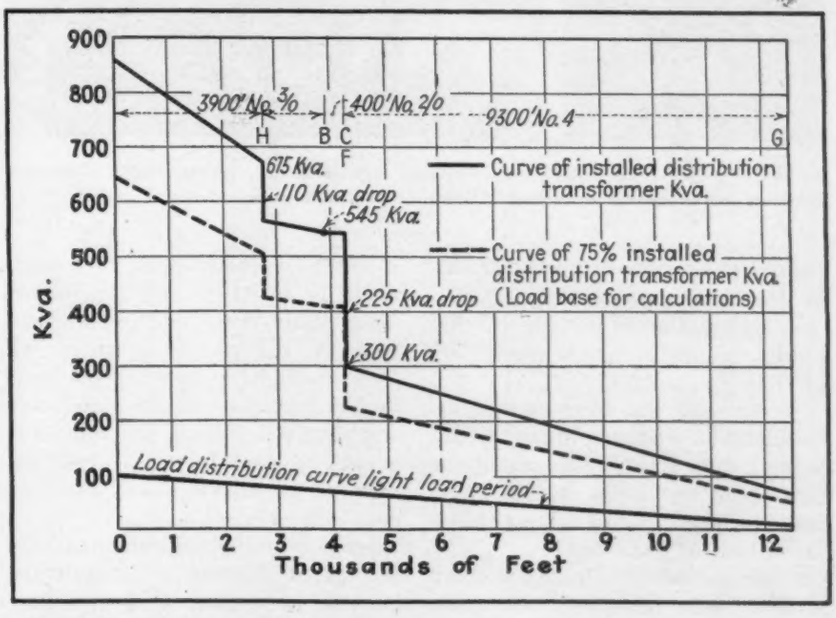
On account of customers located near the substation, it was not considered advisable to maintain the voltage at that point above 120. There was a swing of about 9 percent in voltage on the feeder from light to full load conditions. Customers beyond the mid-point of the feeder, which is about 2.6 miles long, received voltages at full-load periods which were too low to provide satisfactory operation of electric ranges. An appreciable loss of revenue to the lighting department resulted. In the purchase power contract a penalty clause applies to power factors below 85 percent.

The circuit make-up consisted of 3,900 circuit ft. of No. 3/0, 400 ft. of No. 2/0, 300 ft. of No. 0, 1,200 ft. of No. 2, 9,300 ft. of No. 4, 1,300 ft. of No. 1/0, 400 ft. of No. 6, 200 ft. of No. 6 three-conductor underground cable, 100 ft. of No. 6 wire and 150 ft. of No. 6 three-conductor underground cable. The maximum load at the substation was approximately 585 kw. Power-factor varied from approximately 0.90 to 0.60, depending on the time of day and type of load predominating. Phase spacing (equivalent delta) was 19 in. and the distribution transformer capacity connected was 860 kva.

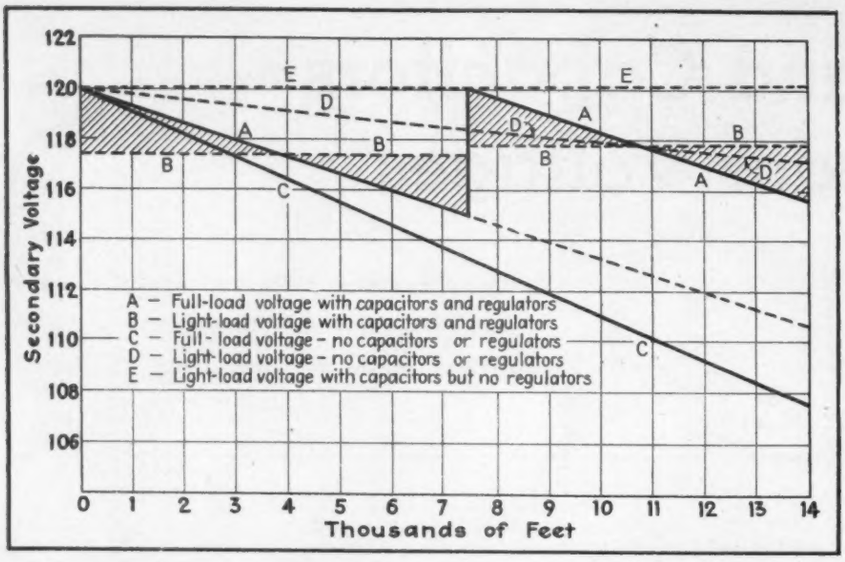
Readings of energy delivered to the feeder in 1938 totaled 1,402,400 kw.-hr.; in 1929, 1,628,400 kw.-hr., and



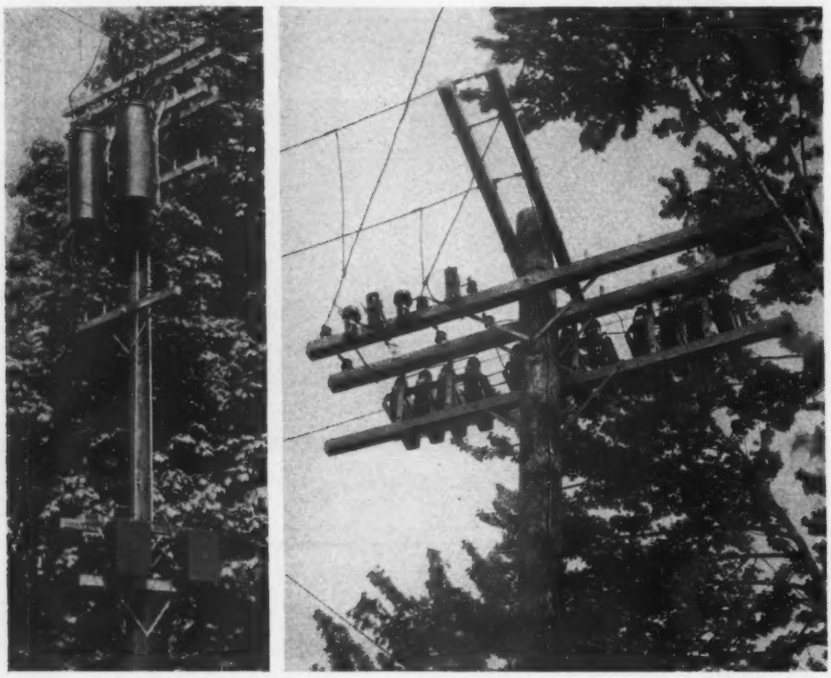
SCHEMATIC MAP showing prevailing conductor sizes on Norwood's feeder No. 3



CONNECTED transformer load grouped along feeder


Secondary Voltage
122
120
118
116
114
112
110
108
106
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
Thousands of Feet
A — Full-load voltage with capacitors and regulators
B — Light-load voltage with capacitors and regulators
C — Full-load voltage — no capacitors or regulators
D — Light-load voltage — no capacitors or regulators
E — Light-load voltage with capacitors but no regulators

ESTIMATED voltage drops along feeder under various load conditions with and without capacitors and regulators



POLE-TYPE (G.E.) regulators and auxiliary equipment on feeder (left). Capacitor bank at end of overhead section of feeder adjacent to pumping station (right)

for five months of 1940, 646,900 kw.-hr. During this period the maximum monthly input to the line was 187,400 kw.-hr. and the minimum was 88,600 kw.-hr.

In studying the feeder it was assumed that a 5 percent voltage spread between light and full load conditions throughout the entire length would prove satisfactory, and this was taken as the base of procedure.

Three methods of solving the feeder problem were considered. First, by increasing the size of copper, which would have required an investment of about $3,700 in new copper and labor. While this would result in satisfactory voltage conditions at full load, it offered no relief to the overloaded regulators at the substation and provided nothing for additional growth of load. This step would not improve the circuit power factor or reduce the kva. demand.

Second, by splitting the circuit into two parts, allotting about half the load to each part. This procedure would not only require duplication of the copper throughout the circuit but would also require a new regulator position in the substation, space at the time being lacking for this. The cost of enlarging the substation for one circuit was prohibitive.

Third, by installing pole-type regulators and capacitors on the feeder. This method represented an investment cost of about $3,000 and would liquidate itself in about eighteen months through savings in power cost and revenue increases. Further, this method would unload the existing regulators in the substations, thereby relieving a dangerous condition. It would provide satisfactory voltage regulation throughout the length of the feeder, give good voltage to all customers, reduce power losses, increase circuit revenue and provide for about five years of load growth, assuming an increase of 5 percent annually. This method was therefore adopted.

Capacitors Installed

Twelve 15-kva. General Electric capacitors were installed at the pumping station end of the circuit, resulting in a voltage rise of approximately 2 percent at this point, under both light and full load conditions. It was estimated that the previous carrying capacity of the circuit at 70 percent power factor with a maximum voltage drop of 5 percent was about 430 kw. The addition of the capacitors, it was estimated, would raise the feeder carrying capacity to about 550 kw., a 28 percent gain. The power loss reduction was estimated at about 39 percent at 70 percent power factor and 23 percent at 85 percent power factor. Based on a circuit load of 525 kva. and 85 percent power factor, the annual reduction in circuit power losses was estimated at 26,800 kw.-hr., representing at 1.2 cents per kilowatt-hour the purchase price at the substation, $322 saving per annum. With a capacitor cost of about $1,100, the annual savings in power loss alone, due to their application, were estimated at about 30 percent of the initial investment.

To solve the problem completely the installation of pole-type induction regulators was found advisable to maintain the voltage spread from light to full load within the 5-volt band selected. These represented an investment of about $1,800. On the

[*Continued on page* 133]

Manufacturing Survey Reflects Power Salesmen's Work

Thirty-three industrial areas accounted for 54 percent of the nation's motor horsepower, 55 percent of the motors driven by purchased energy and 46 percent of the purchased energy in 1939

STRIKING EVIDENCE of the continuing activity of the nation's power salesmen and of the increased reliance on purchased power is presented in a breakdown of the 1939 Census of Manufactures as it applies to 33 industrial areas in the United States. According to this analysis, reported by the Bureau of the Census, manufacturing establishments in these areas had 24,930,421 hp. of electric motor installations in 1939, as compared with 18,835,238 in 1929, a gain of 32 percent. Sixty-six percent of these motors were driven by purchased energy; *this* motor classification showed a 36 percent gain in the ten years since 1929!

Electric energy purchased by the factories in these 33 regions amounted to 20,703,344,530 kw.-hr. in 1939, as against 18,015,212,113 in 1929, or a 15 percent increase in the period, and by 1939 electrification in these factories (ratio of motor horsepower to aggregate horsepower) has increased to 95.5 percent from 87.5 percent in 1929.

Of the 33 areas, Chicago was first in horsepower of electric motors with 13.5 percent of the total, first in horsepower of motors driven by purchased energy with nearly 11 percent of the total, and first in energy purchased with 10.3 percent of the total. An accompanying table gives complete tabular data for the 33 industrial areas and for the country as a whole, for the calendar year 1939.

Prime Movers, Motors, Generators and Electric Energy for 33 Industrial Areas, 1939

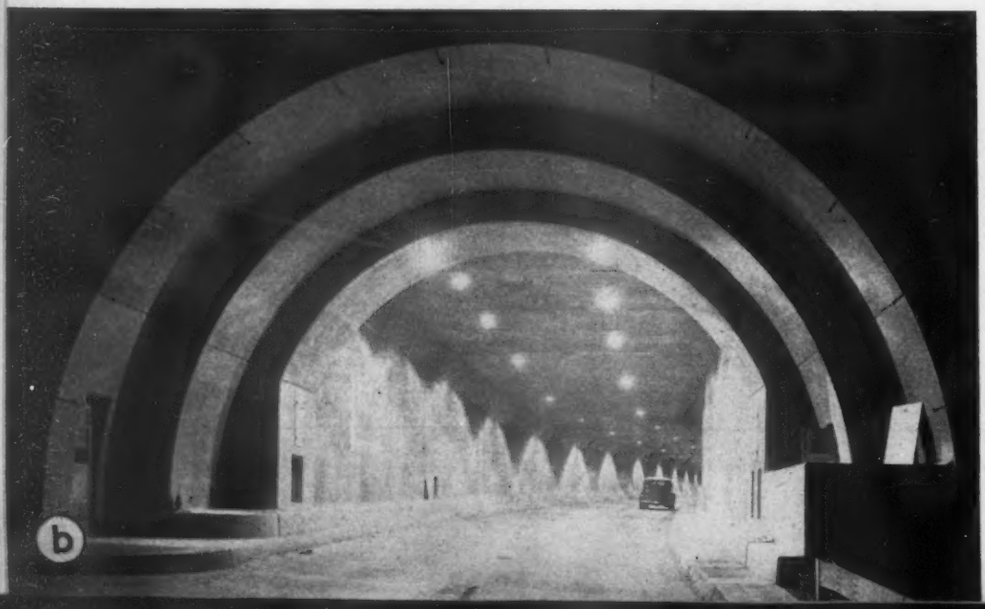
Industrial Areas	Aggregate Horsepower	Prime Movers, Horsepower	Electric Motors Driven by Purchased Energy		Electric Motors Driven by Plant Energy		Electric Generators Kilowatts	Electric Energy in Thousands of Kilowatt-Hours		
			Number	Horsepower	Number	Horsepower		Generated	Sold	Purchased
United States, total	**51,124,298**	**21,236,332**	**4,138,169**	**29,887,966**	**1,224,637**	**16,078,658**	**9,656,934**	**28,749,940**	**2,922,940**	**45,040,075**
33 industrial areas	**26,119,593**	**9,688,480**	**2,325,072**	**16,431,113**	**615,746**	**8,499,128**	**4,368,256**	**11,659,599**	**1,661,226**	**20,703,345**
New York City—Newark—Jersey City	2,338,357	718,258	426,654	1,620,099	67,023	545,495	382,942	927,325	25,602	1,882,523
Chicago	3,181,945	1,418,316	272,005	1,762,629	69,625	1,599,349	644,465	2,002,308	534,430	2,138,404
Philadelphia—Camden	1,432,181	520,472	146,255	911,709	49,367	496,680	241,763	604,519	19,166	1,351,405
Detroit	2,587,680	989,381	162,780	1,598,299	81,100	859,999	555,949	1,505,244	40,310	1,238,622
Boston	982,300	408,468	103,844	573,832	40,987	321,862	225,914	451,610	39,982	571,763
Pittsburgh	2,731,983	1,377,627	83,375	1,354,356	51,830	1,235,064	453,197	1,351,396	576,337	1,812,160
Providence—Fall River—New Bedford	533,407	156,621	73,908	376,786	19,059	105,148	90,516	164,772	7,538	581,742
Cleveland	1,020,642	332,498	99,138	688,144	10,371	338,973	141,765	401,931	3,890	779,601
St. Louis	732,635	265,213	69,355	467,422	14,911	167,196	127,346	306,331	27,510	577,701
Milwaukee	530,022	128,219	61,020	401,803	22,136	176,387	72,449	134,238	2,880	416,034
Bridgeport—New Haven—Waterbury	591,038	187,054	63,441	403,984	19,462	151,138	111,961	230,260	7,799	427,909
Buffalo	1,259,986	201,023	75,758	1,058,963	2,410	26,613	57,364	230,337	3,373	2,965,228
Los Angeles	667,565	85,450	93,840	582,115	2,743	33,825	19,260	70,434	388	797,846
Cincinnati	625,861	255,635	43,429	370,226	20,057	237,269	154,144	408,568	13,818	316,414
Baltimore	722,177	157,852	52,357	564,325	10,246	266,337	67,041	407,199	19,475	641,440
San Francisco—Oakland	587,323	123,133	64,802	464,190	5,374	80,853	48,025	147,608	3,130	615,942
Worcester	410,719	144,555	36,812	266,564	12,326	72,269	83,140	91,378	1,404	281,197
Youngstown	1,193,421	588,618	29,247	604,803	15,885	516,194	176,731	354,712	123,809	662,451
Akron	424,460	234,617	18,516	189,843	15,834	221,833	137,856	435,254	5,522	237,819
Minneapolis—St. Paul	252,266	100,170	30,857	152,096	7,590	62,588	52,459	150,139	59,754	182,563
Hartford	278,747	92,699	35,442	186,048	4,827	30,093	34,876	50,285	6,778	191,427
Rochester	200,512	72,720	29,439	127,792	11,177	44,183	31,913	108,725	37,077	164,812
Albany—Schenectady—Troy	215,527	85,808	23,550	129,719	10,890	59,557	47,156	83,701	148	230,013
Allentown—Bethlehem	557,323	385,243	23,610	172,080	13,645	322,908	113,889	294,001	12,534	408,575
Springfield—Holyoke	256,717	104,526	22,385	152,191	7,581	61,443	61,839	85,063	5,481	160,779
Toledo	250,803	94,200	27,116	156,603	1,778	27,867	31,468	106,724	62,521	186,293
Indianapolis	195,215	31,917	26,719	163,298	3,313	16,857	18,111	24,656	522	191,860
Kansas City	244,685	62,281	23,051	182,404	5,194	38,754	33,092	73,187	76	267,825
Reading	119,277	18,778	19,050	100,499	1,678	6,832	4,666	6,373	2,454	142,317
Seattle—Tacoma	293,279	60,660	24,136	232,619	2,873	54,110	29,414	51,840	1,825	401,880
Wheeling	445,440	234,380	15,078	211,060	8,776	275,904	87,103	338,385	15,691	291,173
Dayton	178,353	35,599	27,428	142,754	3,785	34,489	22,069	48,349	.....	183,465
Scranton—Wilkes-Barre	77,247	16,489	20,675	60,858	1,884	11,059	8,373	12,747	.....	104,160

Mercury Vapor Lamps Light Turnpike Tunnels

Lighting coordinated to eliminate temporary blindness in driver entering tunnels day or night — Open-type mercury luminaires installed in ceilings — Sodium units at approaches and interchanges

L. A. S. Wood, Westinghouse Electric & Manufacturing Company, Cleveland, Ohio*

TURNPIKE TUNNELS are lighted by 1,060 open-type luminaires (insert), which, with H-5 250-watt mercury vapor-lamps in specular stippled Alzak reflectors, are recessed in the ceilings, 37 ft. apart (a) Normal 6-ft.-candle intensity is designed for driving visibility of 1,000 ft. (car ahead is 1,000 ft. away; daylight at tunnel exit is ½ mile distant). At portals (b) illumination level is stepped up to 30 ft.-candles. With flared tunnel entrances, this higher level eliminates temporary blindness in drivers approaching tunnel by day or night.



COMPLETION of 7 miles of lighted tunnels on the Pennsylvania Turnpike, coupled with the prospect of its extension to both seaboards as well as the possible construction of similar freeways as a national defense measure, attaches an important role to tunnel lighting in utility service development.

The electrical load factor of such a modern freeway is high. On the Pennsylvania Turnpike the office, approach and service station lighting are on a 4,000-hour annual schedule, while the tunnel load, including lighting and ventilation, is on a continuous (8,760 hours a year) schedule. Tunnel lighting alone accounts for more than 2,500,000 kw.-hr. a year; the total lighting load is 375 kw., and each of the blower fans in the seven tunnels is directly driven by a 250-hp. motor.

The Pennsylvania Turnpike stretches for 160 miles through the Appalachian Mountains, linking the state capital, Harrisburg, with the great industrial area of Pittsburgh. More than 110 miles of the four-lane highway is perfectly straight, maximum grade is 3 percent and the worst curve is 6 deg. There is a speed limit of 70 miles per hours on the open road, and at all approaches to highway hazards there is a 50-mile speed limit which is reduced to 35 miles per hour at the hazard. The 35-mile limit is also maintained in the tunnels, where the dual-lane roadway is cut to two oppositely directed traffic lanes.

Supplying power to such a highway requires that sources be strung out along its length, for it is perhaps the nearest thing to the exact opposite of

*Chief lighting engineer.

a concentrated load. As a result, energy is supplied by four utilities along the route. From east to west along the highway these companies are the Pennsylvania Edison Company, the Potomac Edison Company, the Pennsylvania Electric Company and the West Penn Power Company. Primary voltages of from 13 to 25 kv., single-phase, 60 cycles are transformed to 2,300 volts. Sodium butterfly luminaires for lighting the tunnel approaches and the interchanges—where traffic flows in and out of the main highway—operate on 220/110-volt circuits and are connected in series on a constant-current circuit through 6.6-amp. regulators, primaries of which are connected to the utility supply lines. Each of the mercury-vapor lamps in the tunnels is operated from the secondary of an individual transformer located in inclosed wall niches; primaries of these transformers are connected across a 2,300-volt, 60-cycle multiple circuit. Other lighting circuits are fed by parallel circuits through step-down distribution transformers.

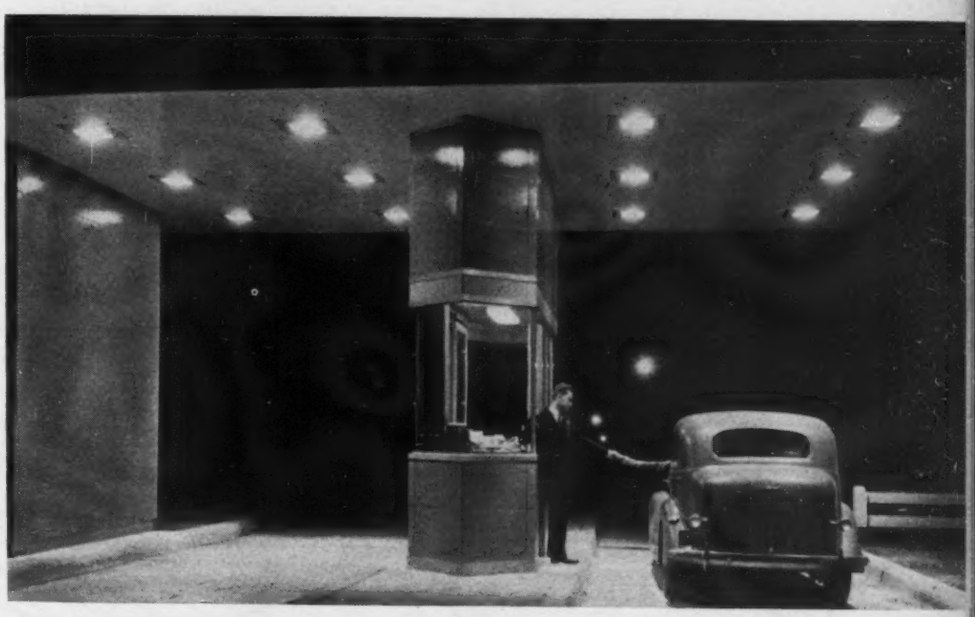
TUNNEL APPROACH lighting extends an average of 1,800 ft. out from tunnels. On approaches (as well as at traffic interchanges) "butterfly" sodium vapor luminaires are used, because their yellow color acts as a caution signal on the motorist. They are suspended from overhanging arms on wood and steel poles, 25 ft. above roadway and extending about 6 ft. over edge of concrete. Units are spaced at intervals gradually increasing from 125 to 300 ft. going away from portals.

Emergency Lighting

In the unlikely event of power failure, each tunnel affected can be lighted by an emergency battery-operated system. Emergency fixtures —there are 242 for the seven tunnels —are spaced 300 ft. apart in alternate rows, and provide sufficient illumination for discernment of normal hazards in the tunnels. Batteries and controls are located in control rooms at the tunnel portals. The 120-cell storage battery at each station is kept charged automatically by a 7½-kw. generator, driven by a gasoline engine.

After a consideration of possible light sources for the highway, the Turnpike Commission finally decided on the 10,000-lumen sodium-vapor lamp for interchanges and approaches to exits, overpasses and tunnels. This decision was based on the instinctive slowing-down effect on the motorist of the distinctive yellow color as evidenced by other installations, as well as on the successful operation of this type of lighting source in similar service. Ticket booths and offices use 40-watt fluorescent and 250-watt incandescent lamps. Tunnels use the 250-watt, 10,000-lumen high-intensity mercury-vapor lamp.

Three characteristics of the mercury-vapor lamp governed its selection for this installation, its first application to tunnel lighting. In the first place the blue-white mercury color of the mercury lamp emission renders contrasts clearly visible; this has been demonstrated in its use for fine work in industrial plants. Second, the light source of the "H-5" 250-watt mercury-vapor lamp is concentrated, permitting efficient control of the light flux and its effective distribution by suitable reflecting media. Finally, tests have shown the life of the H-5 lamp on continuous burning, such as is required in tunnel lighting, to be exceptionally long.



TICKET SELLER has 45 ft.-candles on his desk inside the office from four 40-watt white fluorescent lamps, shielded by metal louvers. Outside areas under the marquee are lighted by flush-mounted, glass-inclosed incandescent units. Five of the six are 200-watt fixtures.

Four major features distinguish the turnpike tunnel lighting from similar, previous installations. First of all, the mercury-vapor lamp is employed as the illuminant, whereas previously, the tungsten filament lamp has been generally employed, although

[*Continued on page* 131]

Designed Voltage Regulation on REA Rural Circuits

Effect of impedances of multi-grounded neutral lines and of earth resistivity — Wire factors, demands, cumulative drops tabulated

BRUCE O. WATKINS, Rural Electrification Administration*

BEFORE construction of an REA system the project engineer is requested to make a voltage regulation study. Special forms have been devised for this work, resulting in a uniform system and simplified checking. The distribution system is divided into short sections, these sections being taken at points where the conductor size changes, where the phasing changes, at main junctions, where long single-phase lines tap off, or where there are concentrated loads. In picking the sections effort is made to keep the load in each section as uniform as possible. The assumption is then made that half the total uniform load is concentrated at the end of the section, plus, of course, all load beyond the section.

Up to last year no recognition was given to the power flow in the earth, although practically all REA systems are multi-grounded neutral type. Now calculations are made including the effect of the earth circuit.

From simplified Carson's formulas the self-impedance of ordinary 60-cycle power circuits with ground return is

$$z_c = r_c + 0.0954 + j0.2794 \log_{10} \frac{D_e}{R} \quad (1)$$

and the mutual impedance is

$$z_{ab} = 0.0954 + j0.2794 \log_{10} \frac{D_e}{d_{ab}} \quad (2)$$

where r_c = resistance of conductor

D_e, the equivalent depth of earth return,

$$= 2{,}160 \sqrt{\frac{\rho}{f}}$$

where

ρ = earth resistivity, ohms per cubic meter

R = geometric mean radius of conductor (G.M.R.)

f = frequency

d_{ab} = distance between conductors a and b (or geometric mean distance between a and conductor group b)

For a single-phase thoroughly grounded neutral circuit

$$E_a = I_a Z_{aa} + I_n Z_{an}$$
$$E_n = O = I_n Z_{nn} + I_a Z_{na}$$

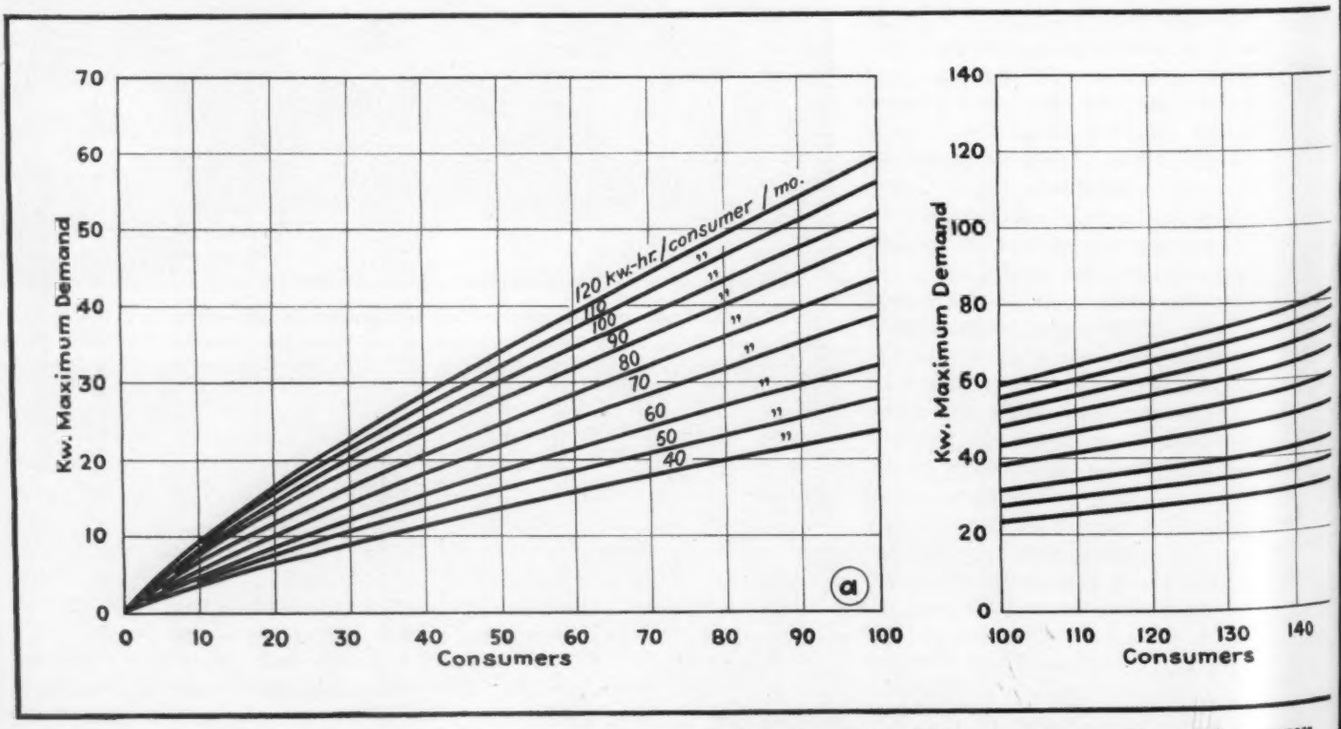


Fig. 1—Peak demands used for REA system design. Above 100 consumers

*Head Operating Problems Unit, Technical Standards Division.

Hence $\frac{E_a}{I_a} = Z_L = \left(Z_{aa} - \frac{Z_{an}^2}{Z_{nn}}\right)$ (3)

Z_{aa} and Z_{nn} are self-impedances where a and n are the conductors, $Z_{an} = Z_{na}$ mutual impedances and Z_L is the equivalent circuit impedance. The self and mutual impedances are calculated from formulas (1) and (2) above.

Since no circuit is thoroughly grounded at zero potential a correction term should be added to account for ground contact resistance. For most conditions, however, the error in assuming no ground contact resistance is very small. For example, with six grounds per mile of 100 ohms each and an earth resistivity of 100 meter-ohms, the percent error on a 50-mile line of No. 11 copper equivalent is less than 6 percent, and for larger conductors the error is much less than this. REA lines are grounded at every transformer and at least every 1,000 ft., and many projects are now using pole butt-type grounds on every pole.

Earth Resistivity

Since the logarithm of the square root of the earth resistivity enters into the impedance formula, a large change in earth resistivity results in only a minor change in impedance. For example, No. 4 copper with an earth resistivity of 10 gives an impedance of about 2.01 ohms per mile, while an earth resistivity of 1,000 gives 2.14 ohms per mile.

For two phase wires and neutral, the exact equation is difficult to solve, as the drop in the two phases is unequal and depends on which phase is leading.

Equations similar to those above can be set up, resulting in

$$E_b = I_b\left(Z_{bb} - \frac{(Z_{bn})^2}{Z_{nn}}\right) + I_a\left(Z_{ab} - \frac{Z_{an}\,Z_{bn}}{Z_{nn}}\right) \quad (4)$$

$$\text{and } E_a = I_a\left(Z_{aa} - \frac{(Z_{an})^2}{Z_{nn}}\right) + I_b\left(Z_{ab} - \frac{Z_{an}\,Z_{bn}}{Z_{nn}}\right) \quad (5)$$

Z_{nn}, Z_{aa} and Z_{bb} are self-impedances and Z_{an} and Z_{bn} mutual impedances, using formulas (1) and (2).

By plotting curves for different values of I_a and I_b the drop could be made equal in each phase by proper loading* (if there were no ground return, equations 4 and 5 would be the same as above, but different formulas for self and mutual impedance would be used. This would be the case if three-wire open delta wiring were used).

If I_a and I_b were equal, and 120 deg. apart,

$$Z_{La} = \left(Z_1 - \frac{Z_2^2}{Z_{nn}}(1 + a_2) + a_2 Z_{ab}\right) \quad (6)$$

$$Z_{Lb} = \left(Z_1 - \frac{Z_2^2}{Z_{nn}}(1 + a) + a\,Z_{ab}\right) \quad (7)$$

where $Z_1 = Z_{aa} = Z_{bb}$

$Z_2 = Z_{an} = Z_{bn}$

$a = -0.5 + j0.866$

For REA work a balance could never be made in the field as close as indicated by curves plotted from the above formulas 4 to 7, but the formulas are included here for those interested in cases where the load can be more closely controlled. For practical purposes, REA takes *the drop in such a circuit* as equal to *half of that in a single-phase circuit for the same load, and the drop is taken as equal in each circuit.*

Three-phase circuits are considered balanced, and the impedances calculated in the conventional manner from the formula

$$Z_L = r_a + 0.2794 \log_{10}\frac{G.M.D.}{R} \quad (8)$$

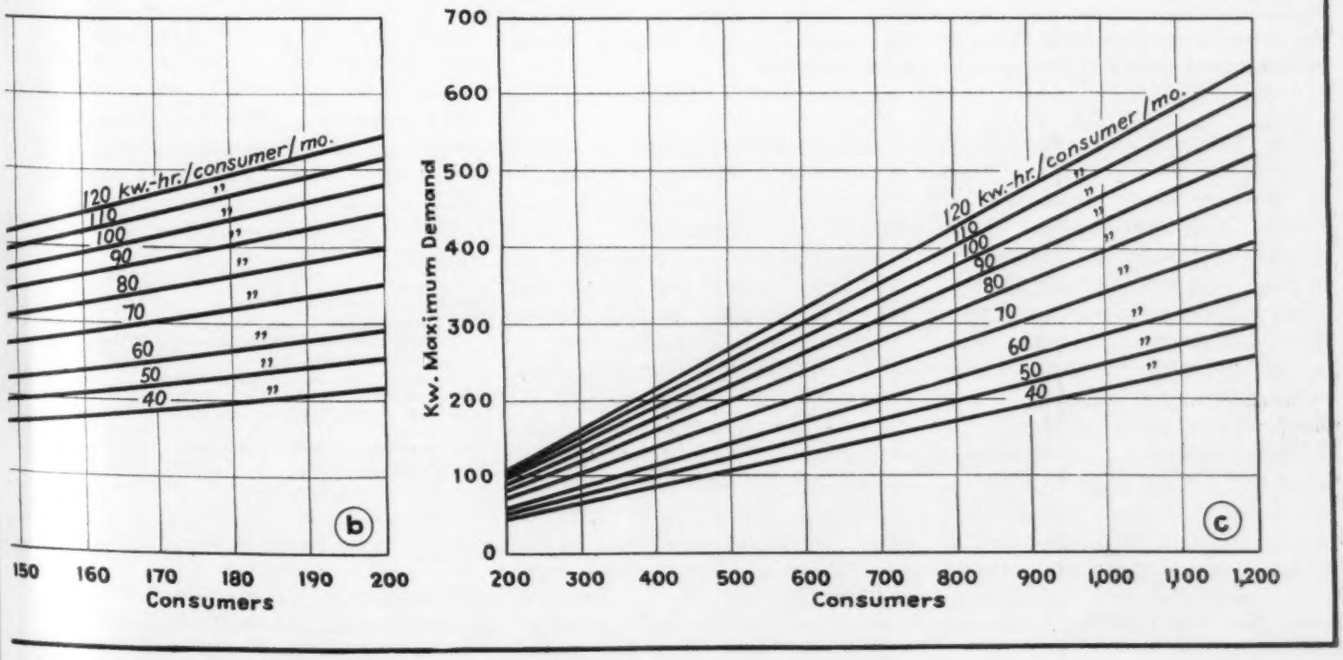
where $G.M.D.$ = geometric mean spacing of conductors

$= \sqrt{D_1\,D_2\,D_3}$ for three conductors.

Neutral Conductors

For single-phase lines the size of the neutral conductor has little effect on the impedance of the circuit. For example, the impedance of a No. 4 copper conductor with No. 4 neutral (earth resistivity equals 100) is 2.08 ohms per mile, while a No. 4 with a 9½D copperweld neutral is 2.17 ohms per mile. Since the three-phase cir-

* See also relation between voltage drop and load balance in an open-Y distribution circuit, Apostal and Wickstrom, *Electrical Engineering*, April, 1937.



there is very little diversity in demand. Line loss is included

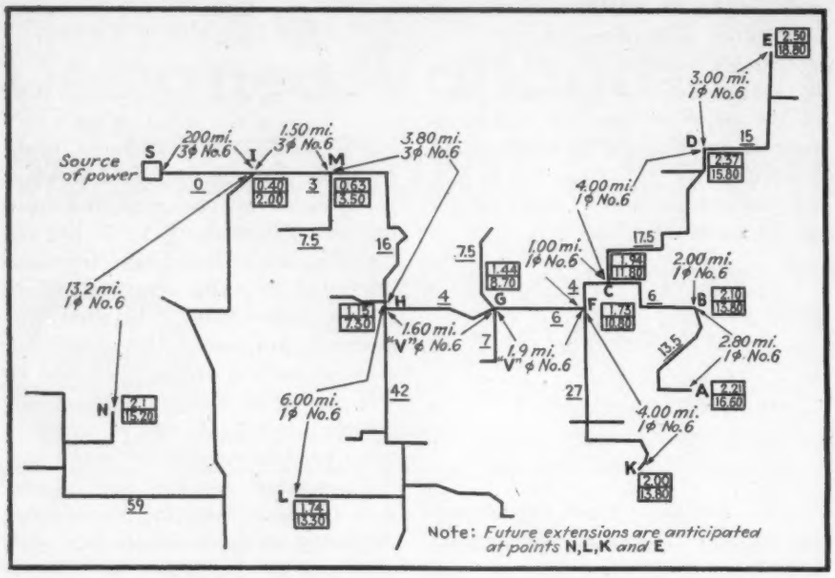


Fig. 2—Form of diagram used to record loading
Sketch merely illustrates a hypothetical configuration (not an actually designed pattern) for which corresponding hypothetical data are tabulated and computed in Fig. 3. Underscored numbers are for estimated ultimate number of consumers. Upper boxed figure at junctions is estimated percent voltage drop at full load from source to point indicated. Lower boxed figure is distance in miles along circuit from source.

FORM E.O. 99

DEP'T OF AGRICULTURE. RURAL ELECTRIFICATION ADMINISTRATION

VOLTAGE REGULATION SHEET

PROJECT SOMESTATE-14-JONES SHEET 1 OF 2
SUBMITTED BY JOHN DOE DATE Mar. 20, 1940
CHECKED BY DATE

NOT TO BE USED BY PROJECT ENG. REVISED BY DATE
APPROVED BY DATE

(0) SECTION	(1) NUMBER OF CONSUMERS SIGNED THIS SECTION CUMU.	(2) POTENTIAL THIS SECTION CUMU.	(3) ULTIMATE * THIS SECTION CUMU.	(4) BEYOND THIS SECTION	(5) EQUIV. THIS SECTION	(6) K.W.H. PER MO.	(7) KW. PEAK **	(8) LENGTH OF SECTION IN MILES	(9) KW. MILES	(10) COND. SIZE CU. EQUIV.	(11) φ	(12) WIRE FACTOR	(13) % VOLT. DROP THIS SECTION	(14) % VOLT. DROP ACCUMULATIVE	(15) AT POINT	(10A) COND. SIZE CU. EQUIV.	(11A) φ	(12A) WIRE FACTOR	(13A) % VOLT. DROP THIS SECTION	(14A) % VOLT. DROP ACCUMULATIVE
A–B	12	3	13.8	0	6.75	100	9.85	2.60	16.4	6	1 / 7.2	6.70	0.11	2.21	A					
	12	3	13.8																	
B–C	4	4	6.0	13.8	10.80	100	12.15	2.00	24.3	6	1 / 7.2	6.70	0.16	2.10	B					
	16	7	19.8																	

* THIS IS THE SUM OF THE SIGNED MEMBERS AND 1/2 THE UNSIGNED PROSPECTS.
** TO BE TAKEN FROM PEAK DEMAND CURVES.

Fig. 3—Table records data and computations for voltage regulation on rural circuits. The letters in the "Section" column refer to the points so marked in Fig. 2. Section voltage drop is kw.-miles/1,000 multiplied by wire factor

cuit is fairly well balanced, the neutral wire size has practically no effect on line impedance in three-phase sections. This leads the way to use of smaller sized neutral conductors on REA systems. The use of such reduced-sized conductors usually presents a mechanical rather than an electrical problem. The two conductors must have sufficiently close characteristics under all conditions of loading to maintain adequate separation and correct ground clearance, and although not a great many conductors meet these requirements, REA now uses several such combinations. Galvanized steel neutral conductor has been considered, but not used so far.

From experience with projects in operation, the curves in Fig. 1 have been prepared for project demand as a function of the number of consumers and the average monthly consumption. Line loss is included in the curves. It can be seen that there is very little diversity in this type of load for more than 100 consumers.

From known local conditions and experience with other projects in the area the project engineer, with the approval of REA, estimates average anticipated consumption on the project and then applies the curves in Fig. 1 directly for the demand on the line sections. A map of the project, with the location of all consumers both signed and potential, is used in making the study. Data are assembled on a key map and on a voltage regulation sheet of the form shown. (In estimating future loads half the potential consumers are included.)

The "regulation" sheets have spaces for revision by the REA field engineer. Concentrated loads, as above stated, must be handled separately, by taking the estimated peak load directly. In some cases, if the power factor is appreciably less than 90 percent, new wire factors must be calculated.

Wire Factor Formula

The wire factors in the accompanying table were calculated from the formula

$$W.F. = \left(\frac{R_{\cos\theta} + X_{2\sin\theta}\,(100)}{\cos\theta\,(Kv)^2\,(0.96)} \right) \quad (9)$$

where $\cos\theta$ = power factor
Kv = line to ground kilovolts
R = circuit resistance per mile
X = circuit reactance per mile

The formula assumes an average drop of 4 percent on the circuit. Such a wire factor formula is quite accurate for fairly high power factors, but of course cannot be used for low power factors.

In recommending these wire factor values to REA projects for voltage regulation purposes an arbitrary increase of 5 percent was made in the figures for single-phase lines to allow for ground contact resistance and change in earth resistivity. A figure of 100 ohms per cubic meter was used throughout as representing an average earth resistivity.

The G.M.R. values for most conductors are now generally available. For copperweld conductors the G.M.R.'s are not widely known. A 1934 report of a E.E.I.-Bell System joint committee gives the following values for P, where $G.M.R. = Px$ (radius of conductor). The proper $G.M.R.$ values must be used in equation (1).

Strands	Conductors	P
7	Seven copperweld wires	0.223
7	Three copperweld, four copper wires	0.3165
1	Solid copperweld	0.287
3	Type A, one copperweld, two copper wires	0.333
3	Type D, two copperweld, one copper wires	0.242
19	Seven copperweld and twelve copper	0.564
3	Three copperweld	0.223

For a solid, non-magnetic conductor, $P = 0.779$*.

Wire Factor Table

Wire factors for multi-grounded neutral lines only. Percent drop for 1,000 kilowatt-miles, 90 percent

[*Continued on page* 137]

Relative Costs of Industrial Light Sources

Incandescent lighting shown most economical for low energy rates — Both initial and operating costs considered in comparative cost analysis of various types of lighting sources

C. C. MILLS, Holophane Company, Inc.

MOST industrial lighting engineers are interested in procuring the best lighting possible at the lowest operating cost. To aid them in this objective the following cost analysis, taking account of all data for various types of lighting sources, was prepared. From the economic comparisons made these conclusions were reached:

1. Incandescent units are more adaptable to increasing the generated lumens per unit than any other system because lamps of varying wattages can be used in the same fixture; this accounts for continued low overall costs as foot-candles increase. In addition, the incandescent system has the lowest operating cost for energy rates less than 0.6 cent per kw.-hr. The initial costs are also lower than for any other system regardless of the foot-candles desired.

2. The mercury system is very economical in producing high foot-candle levels at average mounting heights with costs around 1 cent per kw.-hr. The initial cost is about midway between the low figures for incandescent and the high for white (a.c.) fluorescent.

3. The mercury-incandescent arrangement is generally more expensive to operate at foot-candles above 40 regardless of energy rates. The initial cost in all cases is a few cents per square foot less than for the mercury system.

4. The rectified (d.c.) fluorescent scheme of lighting is the most economical to use for mounting heights over 9 ft. when current rates are above 1.0 cent per kw.-hr. However, the cost is relatively high, compared with the mercury and incandescent systems as well as the combination of the two.

5. The white fluorescent system has a slightly higher operating cost than the rectified fluorescent throughout the foot-candle range at kw.-hr. rates from 0.5 through 2.5 cents. This type of lighting, moreover, has the highest initial cost of any of the systems.

Finally, if the working year should be less than 4,000 hours, the operating cost of the incandescent system becomes more favorable, with additional economies as the hours grow fewer. As the working hours increase beyond 4,000 a year, the fluorescent system becomes more economical to operate. Another interesting point is that from 20 to 60 foot-candles at 18-ft. mounting height and 0.5 cent per kw.-hr. the operating costs for all types of lighting sources are about the same.

Comparative Costs of Various Types of Industrial Lighting

Intensity of Illumination	Type of Light Source	Initial Costs in Cents per Sq. Ft.		Operating Costs in Cents per Sq. Ft.					
		9-Ft. Mounting Height Above Work	18-Ft. Mounting Height Above Work	9-Ft. Mounting Height Above Work			18-Ft. Mounting Height Above Work		
				0.5¢ Kw.-Hr.	1.0¢ Kw.-Hr.	2.5¢ Kw.-Hr.	0.5¢ Kw.-Hr.	1.0¢ Kw.-Hr.	2.5¢ Kw.-Hr.
20 foot-candles	Incandescent	11.5	7.4	7.8	11.2	22.0	10.1	15.0	29.0
	Staggered Mercury and Incandescent	14.3	9.2	11.2	14.9	25.0	10.8	14.9	26.4
	Mercury	17.0	10.0	13.3	16.7	27.3	10.2	13.2	22.1
	White Fluorescent	21.4	20.0	11.0	12.5	17.0	10.5	13.0	19.7
	Rectified Fluorescent	17.1	16.0	9.0	10.2	14.0	10.3	12.0	16.2
40 foot-candles	Incandescent	13.0	13.8	13.3	19.8	40.1	19.1	28.5	56.7
	Staggered Mercury and Incandescent	13.9	17.2	15.3	21.4	39.1	19.8	27.4	50.2
	Mercury	16.1	20.5	14.7	19.5	32.4	19.0	24.7	41.5
	White Fluorescent	33.5	40.0	17.5	21.1	32.2	21.0	25.5	38.0
	Rectified Fluorescent	26.5	31.5	16.8	19.3	26.8	19.7	22.5	31.3
60 foot-candles	Incandescent	14.4	20.8	18.8	28.0	58.3	28.0	42.0	84.1
	Staggered Mercury and Incandescent	20.9	25.2	22.7	31.5	58.5	28.7	40.0	73.8
	Mercury	24.1	31.0	22.2	29.0	49.7	30.1	39.0	65.7
	White Fluorescent	50.0	59.9	26.5	32.0	48.4	31.5	37.9	56.5
	Rectified Fluorescent	39.8	47.0	24.5	28.2	39.4	28.8	33.1	46.3

Cost Figures Used

In making this co-operative cost analysis these figures were used:

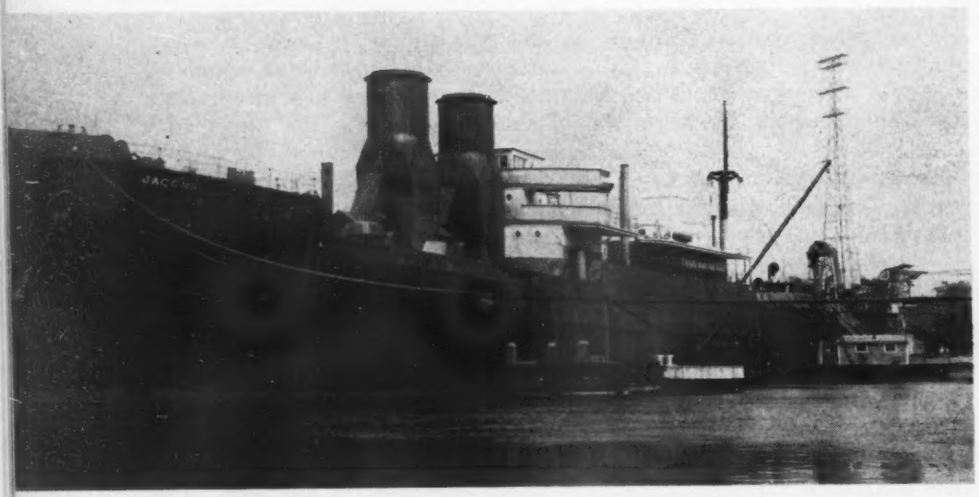
Initial or Ownership Costs—(1) Wiring cost of $12 per outlet, which includes wire, conduit, outlet, switch panel and labor. This average cost was established from information furnished by several leading electrical contracting companies representative of the various sections of the country. The elimination of the wiring cost when existing outlets are to be utilized slightly affects the relative comparative operating costs of the various systems.

[*Continued on page 69*]

Floating Plant Serves Base Load

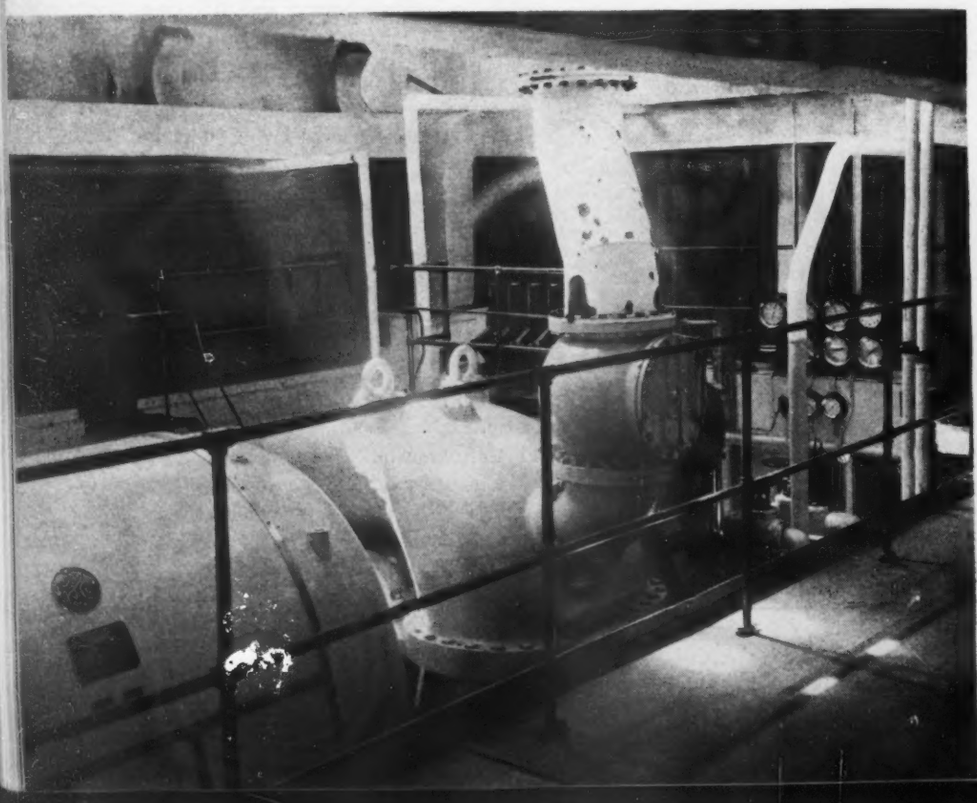
20,000-kw. steam installation on power ship "Jacona" proves highly reliable source of energy for New Hampshire utility — 1940 fuel rate 15,000 B.t.u. per kw.-hr.

WILLIAM NOYES,* Public Service Company of New Hampshire, Manchester, N. H.



POWER SHIP *Jacona* moored at operating site

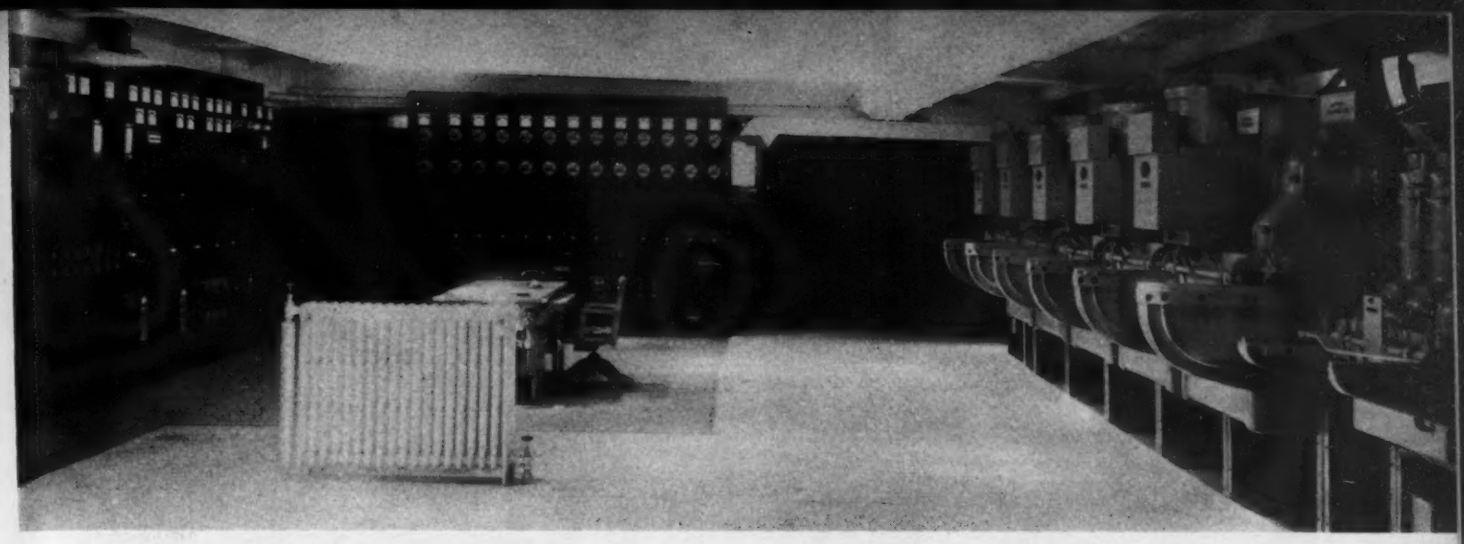
ONE OF THE TWO 10,000-kw., 3,600-r.p.m. steam turbine units aboard the *Jacona*



SINCE the spring of 1931 the floating power plant *Jacona* has been in base load service at moorings in the Piscataqua River near Portsmouth, N. H., providing the Public Service Company of New Hampshire with 564,000,000 kw.-hr. on an operating schedule closely articulated with the conditions prevailing at the other hydro and steam plants of the company. In view of the widespread interest in this pioneer installation at the time of its initiation into utility service, some results of the past decade of operation are presented. During this period the availability of the plant has been of the order of 90 percent with one unit and 85 percent with two units on the bus. The output has ranged from shutdown under the most favorable hydro conditions on the system to about 22,000 kw. under low water in the rivers. The plant rating is 20,000 kw. from two 10,000-kw. General Electric turbogenerators and four B & W marine type boilers with auxiliaries. For the ten-year period the load factor has been about 32 percent and the station factor 35 percent.

A detailed description of the *Jacona* was published in *Power* December 9, 1930. She was built as a single-screw two-deck, three-island type cargo steamer of 5,238 gross tons, having a length of 396 ft. and a beam of 53 ft. Conversion to a floating power plant was achieved at a cost of about two-thirds the outlay which would have been required for a land plant of equal capacity. The ship's propelling equipment was all removed in order to make space for the generating equipment and the vessel is

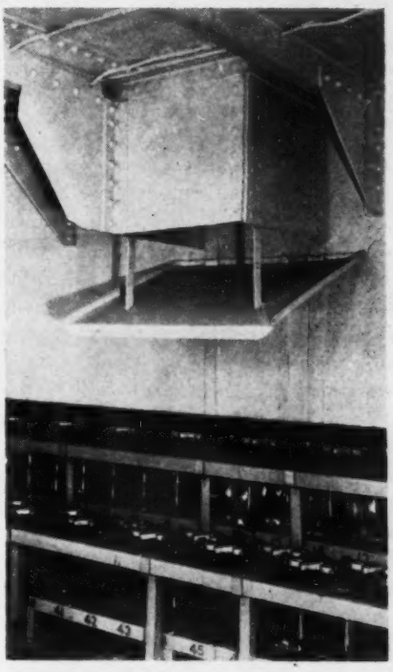
* Operating engineer.



CONTROL ROOM on *Jacona*, with 11-kv. Reyrolle switchgear at right, auxiliary switchboard in center and main switchboard at left. Dispatching office at Manchester governs operation of plant with Bell and carrier telephone connections

towed to the point of use as well as to dry dock when necessary for inspection and overhaul.

Bunker C oil is burned. The *Jacona* boilers are capable of delivering 280,000 lb. of steam per hour at 425 lb. pressure and 250 deg. superheat. Near the center of the ship are four built-in steel oil tanks holding 250,000 gal., or about five days' supply at full load. Tanks in the double bottom are not used, as the principal oil supply is stored in two shore tanks aggregating about 4,580,000 gal., an 80,000-bbl. tank having been added last winter to provide a reserve capacity of fuel and save through freighting the oil directly from the refinery in large tankers. The removal of an old bridge and construction of a new one at Portsmouth enables large tankers to move up the river to the *Jacona* site, where the fuel is pumped into the shore tanks. These tanks are now available for filling tank cars for delivery of fuel by rail to the company's 20,000-kw. steam station at Manchester, which went into service in 1939 (ELECTRICAL WORLD, June 29, 1940). Oil is delivered to the *Jacona* by gravity from these tanks, the maximum head being about 60 ft.

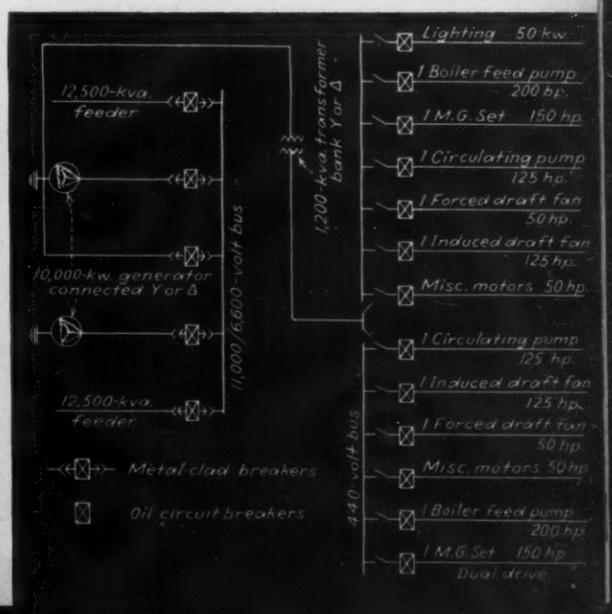


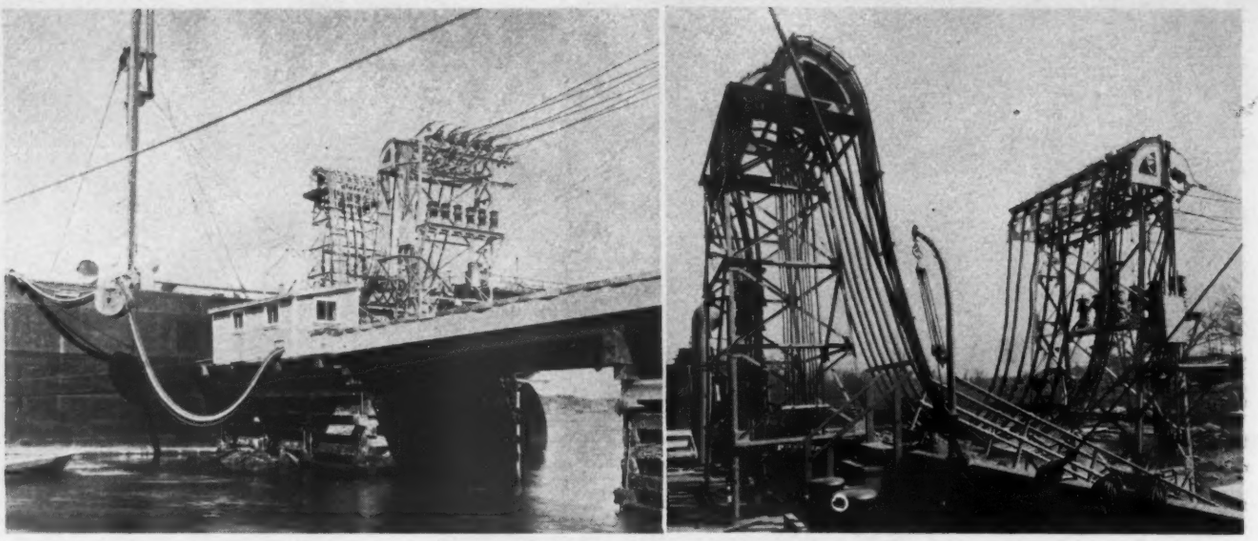
CONTROL BATTERY with ventilation and weather shield above and bar protection against rolling

Two boilers serve each turbine and operation in units is a feature of the layout. Eleven Cuyama oil burners serve each boiler; there are one turbine-driven and two motor-driven feed pumps. Two boilers are provided with desuperheating coils, this steam being used for heating fuel oil and operating auxiliary equipment. One forced-draft and one induced-draft fan are associated with each pair of boilers, with variable-speed motor drives controlled from the boiler room floor. Furnace walls are of high-grade brick, with one stack for each pair of boilers. Interdeck superheaters are provided, with closed feedwater system.

Condensing water can be taken from either side of the ship. Generators are designed for operation at

SUPPORTING generator leads on lower deck. Six cables per generator are provided, these being carried on insulators supported by 3¾x2¾x½-in. angles and 2¼x⅜-in. vertical straps (left). One-line diagram of *Jacona* main and auxiliary wiring layout


12,500-kva. feeder
10,000-kw. generator connected Y or Δ
12,500-kva. feeder
11,000/6,600-volt bus
Metal-clad breakers
Oil circuit breakers
1,200-kva. transformer bank Y or Δ
440-volt bus
Lighting 50 kw.
1 Boiler feed pump 200 hp.
1 M.G. Set 150 hp.
1 Circulating pump 125 hp.
1 Forced draft fan 50 hp.
1 Induced draft fan 125 hp.
Misc. motors 50 hp.
1 Circulating pump 125 hp.
1 Induced draft fan 125 hp.
1 Forced draft fan 50 hp.
Misc. motors 50 hp.
1 Boiler feed pump 200 hp.
1 M.G. Set 150 hp. Dual drive



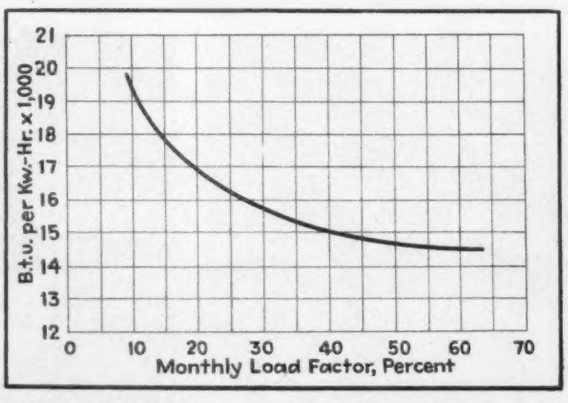
SHIP-TO-SHORE CONNECTIONS (left) contains fresh water supply for the plant (some used for boiler water make-up), fuel oil supply and steam line to fuel oil tank. Ship-to-shore electric cables at right. In the picture at right is a close-up of supporting structures for outgoing power cables and control circuits to meet rise and fall of tides. Lightning arresters are mounted on the shore side. Barrel type frames carry cables without danger of abrasion from up and down movements. While disconnection of cables and other circuits is a slow task, it is necessary only when moving the vessel into drydock or transferring it elsewhere

either 6.6 kv. delta or 11-kv. Y. The steam consumption of each turbine alone at full load is about 9.4 lb. per kw.-hr. City water (1.5 to 2 percent of the boiler feed) is used for make-up.

Electrical Features

Leads from the generator windings are brought to Allis-Chalmers Reyrolle switchgear where connections are made through plug-type units to a 6.6/11-kv. bus, from which the outgoing circuits are led shoreward, a tap also being taken off this bus to a 1,200-kva. transformer bank supplying the ship plant auxiliaries at 440 volts. The control room contains the above switchgear, main and auxiliary switchboards. On account of the rise and fall of the tide (18 ft. maximum), the method of making connections between ship and shore is of interest and has been completely successful in operation. The arrangement consists of specially designed steel towers, on the side of the ship and the dock, each with a barrel crossarm carrying two three-phase, 11-kv., 1,113,000-cir.mil aluminum (equivalent to 750,000-cir.mil copper) armored cables with control cables as well, connecting with the shore substation and switchyard. A loop in the cables between these crossarms allows the ship to rise and fall with the tide. When the vessel is drydocked or moved to another location these cables can be disconnected in about a day, with the aid of block and falls. The control circuits terminate in a metal-clad box on the dock tower, and overhead lines carry the plant output to the substation, where a 30,000-kva. transformer bank steps up the voltage to 66 kv. for a single-circuit connection through Dover to the Public Service company's system. There is also a 33-kv. tie with the New Hampshire Gas & Electric system at Portsmouth. No difficulties have been encountered with the ship-to-shore connections, even under hurricane conditions.

The general scheme of operation is to try to utilize the ship on loads above 2,000 kw., running one boiler up to 5,000 kw. output, two boilers between 5,000 and 11,000 kw., three between 10,000 and 16,000 kw. and four from 16,000 kw. to 22,000 kw., using one or two turbines as required. The ship plant is run at times to improve power-factor conditions on the eastern part of the system, working with a synchronous condenser at Dover. This uses it as a "spinning reserve" or plant floating on the bus. Spinning reserve requirements during times of plentiful water amount to 2,000 to 3,000 kw. of capacity for eight to 14 hours per day. Normal rated output for 24 hours is 480,000 kw.-hr. with two units in service.



APPROXIMATE B.t.u. per kilowatt-hour vs. monthly load factor of *Jacona*

Whenever the water conditions in the hydro plants of the company permit, the load is carried on them, but in times of low flow, like the present summer, the *Jacona* is of great value to the system. Although the newer steam plant in Manchester is slightly more economical in operation when fully loaded, there is a cost differential in fuel oil delivered there and at the *Jacona* which slightly favors the floating plant. A second turbo unit will be added to Manchester in 1942, rated at 10,000 kw., and this will enable the station there to be operated a little more flexibly, the Manchester plant now having one unit of 20,000 kw. rating in service.

In round numbers the *Jacona* has

[*Continued on page* 134]

Cooking Added Profitably to All-Service Commercial Sales

Duquesne Light adds 1,200 kw. through educational program, demonstrations, show, testimonials and increased promotion — Equipment sales reach $30,000

F. A. KOLB,* Duquesne Light Company, Pittsburgh, Pa.

NEW commercial electric cooking equipment totaling 1,200 kw. was installed in twelve months by food service establishments in the Pittsburgh district as a result of the Duquesne Light Company's first year of promotional work in this field. This compares with less than 100 kw. for the year before, when no promotional work was done. The story behind the development of this business is a story of profits for the food service men. These profits have come from the speed and convenience, the controlled temperature, the display value and the economy of modern electric cooking equipment—all of which has meant better food, served faster and more attractively.

Equipment which was sold during the first year of this promotion is listed in the accompanying table and represents an estimated retail dollar value of $30,000. This indicates that the manufacturing companies which formerly had been getting very little business in this territory are now securing a respectable volume, and the local supply houses are doing enough business to arouse their interest and secure their cooperation. As can be seen from this list, the emphasis in the promotion has been on counter equipment.

For the utility company there is an estimated increase in annual revenue, from the 1,200 kw. sold during the first year, of from $25,000 to $30,000. This business has been secured with no wiring allowances. Furthermore, commercial cooking load is billed on the same basis as all other types of commercial load—that is, on a demand and energy basis. In most cases the demand is measured, as all customers with connected loads over 5 kw. have demand meters.

*Director commercial sales.

The Selling Plan

To develop this business successfully in a territory where no previous promotional work had been done we worked out a plan with three steps as follows:

1. Educate the utility salesmen on the merits of electric cooking.
2. Educate the food service operators on the merits of electric cooking.
3. Educate the jobbers to merchandise the equipment.

The commercial sales force of the Duquesne Light Company is an all-service selling organization. This group had no previous experience with commercial electric cooking, having devoted its entire time to lighting and air conditioning. If any success was to be achieved in a cooking program, it was first necessary to give these men sufficient training so that they would be familiar with the results to be obtained with the equipment. Furthermore, it was decided that all of the selling would be done by the salesmen rather than by a cooking specialist. This meant that each man had to be competent in the handling of the equipment. The first step was to send a number of men to the factory of a manufacturer for training. Using these men as leaders and with the assistance of the factory representatives, the salesmen were trained in the actual use of the equipment.

PROFITS for a small restaurant owner result from installation of 6-kw. fry kettle, 2-kw. coffee urn, 4-kw. hot plate, 3-kw. meat grill, 1,250-watt food warmer, 1,000-watt sandwich grill, 1,200-watt soup kitchen and 1,500-watt waffle baker. Total load, 19.95 kw.

DAIRY STORE OPERATOR attains speedy food service through use of 3-kw. meat grill, two 2,450-watt toasters, 425-watt food warmer, two 1,320-watt ovens and one 1,650-watt sandwich grill

TWO 18-kw. ranges and a 7-kw. fry kettle in a compact and efficient kitchen for a large restaurant

After the group instruction was completed the salesmen were tested individually to determine their proficiency. It is important to note that practically all of the commercial men responded very enthusiastically to the cooking promotion, and it is their belief that with cooking to supplement their work on lighting and air conditioning they have a much broader approach to the development of the commercial market.

Out of 34,000 commercial customers there are approximately 2,500 food service establishments in the Duquesne territory. These customers had received no previous information on commercial electric cooking, so it was decided to send the *Build Profits* magazine, prepared under the sponsorship of the Commercial Electric Cooking Council, to each of these customers each month. Furthermore our regular commercial magazine, which is sent each month to 15,000 customers, began to include at least one cooking story each month. These publications were then supplemented with direct mail.

To focus attention on this new promotion three commercial electric cooking shows were held during the first year. The showroom accommodated approximately 80 people, and over a total period of ten days approximately 500 food service operators attended. These shows were very successful, due to the excellent presentation which was made by the man in charge of the demonstrations, and were directly responsible for a large number of actual sales.

As soon as a job was sold a picture was taken and a testimonial secured. In a very short time our salesmen were equipped with pictures of fifteen or twenty local installations, which they found very valuable in educating other customers on the advantages of electric cooking.

Demonstrations

With the advertising program, the electric cooking shows and the photographs and testimonials, our salesmen were able to make a convincing presentation to the customers, but it is quite probable that little success would have been obtained if this had not been followed up by the fourth and most important part—actual demonstration of equipment on the customers' premises. The entire activity was directed toward the goal of getting permission to make demonstrations. These demonstrations were made at no installation cost to the customer, but payment is made for the electric service used. The equipment usually is installed for a period of one week. More than 80 percent of these demonstrations have resulted in sales.

Customer Experience

In addition to the fact that the demonstration gives the customer a firsthand opportunity actually to experience the convenience and speed of electric cooking, it also gives the salesman a chance to quote the customer actual operating cost. This can be done because the customer usually has a demand meter installed, so the actual billing basis is readily determined. In the early months of this program the question of operating cost was very important. It has been our experience that most customers were satisfied with the actual operating cost involved.

This program produced prospects for commercial electric cooking equipment. To turn these prospects into sales it was necessary to have a merchandising plan. The territory of the company is a concentrated one, and in Pittsburgh there are a number of restaurant supply houses. It was decided that the most satisfactory arrangement would be to cooperate with these dealers, who have had contact with food service people over many years. It was recognized that practically all of the creative selling would have to be done by the Duquesne Light Company, but we have been able to obtain excellent cooperation from all of these firms. As they have become better acquainted with the equipment, their interest has increased, with the result that a number of the sales made during this first year were due directly to the efforts of the salesmen of the restaurant equipment firms.

This three-step plan has now been followed for one year, but there is still considerable work to be done in educating the salesmen, the customers and the jobbers. Nevertheless progress has been made and, most important of all, the customers are

satisfied with the equipment they have purchased.

Customer approval is vital to this program, since the first piece of electric cooking equipment must sell the second piece. Without such progressive selling a program is bound to be unsuccessful. Recognizing this, we have endeavored in every case to have the equipment suited to the customer's needs, so that he would keep it operating.

We believe, on the basis of our experience, that the promotion of electric cooking can best be handled as a year-around activity, rather than as a short-term campaign item.

The service problem has been negligible so far because of the excellent quality of the products which the manufacturers are producing. It has been met by replacement units, by training our salesmen to make minor adjustments, and by using several competent electricians. However, as more of this equipment is installed the service problem will naturally increase, and as it does appropriate steps will have to be taken.

List of Cooking Equipment Sold During First Year

	Number of Pieces	Total Kw. Load
Meat grills	48	142
Fry kettles	70	336
Sandwich grills	56	91
Food and roll warmers	56	58
Waffle bakers	36	50
Ranges	5	73
Roaster ovens	82	110
Toasters	96	183
Coffee makers	59	93
Griddles	3	12
Broilers	2	12
Miscellaneous	36	39
Total	549	1199

The importance of the commercial market to the electric utility has been emphasized many times. Previously, we have depended upon lighting, refrigeration, air conditioning, ventilation and miscellaneous motor applications for the development of this market. To this list we have now added commercial cooking, and we find that the average annual consumption per customer for the small light and power classification (under 20 kw. connected load) reached 4,763 kw.-hr. for the Duquesne Light Company in 1940. This is an increase of 6 percent over 1939, and for the first time one of the factors in this increase was commercial electric cooking.

Our plan is to continue telling the story of the advantages of commercial electric cooking to every food service operator, through advertising, through cooking shows and through demonstrations. As dealer cooperation increases and as our experience in this field becomes greater, we feel that commercial cooking will exercise even greater influence in building up kilowatt-hour sales to commercial customers.

Relative Costs of Industrial Light Sources

[*Continued from page* 63]

2. Fixture cost—including auxiliaries when required—was taken as Holophane list price less maximum trade discount.

3. High power factor tulamp transformer necessary to operate the mercury lamps was taken as list price less 15 per cent.

Operating Costs—(1) A 4,000-hour year was assumed. This is an average worker's week of 40 hours for a period of 50 weeks on a two-shift basis.

2. Lamp cost was taken as list price less 33 per cent.

3. Fixture cost is to be amortized in ten years and was accounted as 10 percent of the initial cost for incandescent and mercury systems. Due to the rapid technological developments taking place, however, the fluorescent equipment is to be amortized over a period of five years, which entailed an extra 10 percent charge.

4. Interest, taxes and insurance take 10 percent of the initial cost.

5. Labor cost for cleaning and relamping each open-type incandescent or mercury fixture for mounting heights from 9 to 18 ft. is 20 cents and from 13 to 18 ft. is 25 cents. The labor costs for each closed-type fluorescent fixture is 15 percent higher. These average costs are representative of present-day industrial practice.

6. The kilowatt-hour rates used are complete costs, including generally an incremental energy charge and a demand charge.

In compiling the initial and operating costs for the accompanying table, both the minimum generally used mounting height of 9 ft. above the plane of work and 18 ft. for low-bay areas was taken. Extremes of 0.5 cent per kw.-hr. and 2.5 cents per kw.-hr. were taken, with an in-between rate of 1.0 cent per kw.-hr., which approximates the average industrial rate throughout the country.

There may be some doubt as to why the initial cost should be less for the 18-ft. mounting height than for the 9-ft. height at lower illumination levels for all types of units. The explanation of this is that it is possible to use fewer units with the higher-wattage lamps on the 18-ft. height.

Incandescent Costs Low

The table indicates that an incandescent system of lighting has the lowest operating cost for all mounting heights when the current rate is less than 0.6 cent per kw.-hr. Another factor that is of considerable interest in connection with the incandescent system is that, generally speaking, the initial or ownership cost is lower than for any other type of lighting regardless of mounting height or foot-candles desired. This would indicate that when the current rate is very low the incandescent system is without doubt the best to use.

Additional Factors

However, there are other factors, such as radiant energy and spectral color content, to consider. If cooler foot-candles are desired, or if a color approaching daylight is needed, then it is better to go to the fluorescent systems. In connection with color correction and cooler foot-candles the mercury units have much to commend them. They will produce slightly less sensible radiant energy than incandescent units, watt for watt; their characteristic bluish-green color can be blended with varying amounts of yellowish-white of the incandescent system to form different color values, and finally, it should be noted that a mercury system is most economical to buy and operate when used to produce high foot-candles—40 and upward—at low mounting heights to about 12 ft. at low-current rates of 1 cent and below.

The nearest competitor in operating costs is the rectified fluorescent system, which is slightly cheaper to operate at the 12-ft. mounting height. However, the initial equipment cost for mercury is about half what it is for the rectified fluorescent units.

Salvaged Meter Parts Given Chemical Cleaning

Author details procedures and solutions developed by Detroit utility for chemical cleaning of reclaimed meter parts — Reports results of time studies showing number of parts that can be cleaned per hour

W. A. STURDEVANT, Meter Department, Detroit Edison Company, Detroit, Mich.

IMPORTANT TASK of most meter departments is restoration of reclaimed meter parts. Much valuable material that would be normally scrapped can be saved if salvaging of these parts can be done profitably. Major factor in this work is the cleaning of salvaged parts—removal of deposits or burned material and brightening of parts that have become dirty and discolored due to fire or other causes.

An investigation of cleaning methods made by the meter department of the Detroit Edison Company has led to the application of chemical methods to the cleaning of salvaged meter parts.

Experience with the chemical cleaning methods developed has shown that they possess several advantages over other methods: (1) Chemical cleaning is more thorough and efficient; (2) it involves less labor; (3) costs are lower since many meter parts can be cleaned without dismantling, and (4) the actual cleaning time is very short.

Time studies conducted during the investigation of the chemical cleaning methods showed it was possible to clean:

2,000 complete jewels in 3½ hours.
130 glass meter covers in one hour.
1,500 meter seal bars in one hour.
40 meter connection blocks and parts in three hours.
10 test switches and parts in one hour.

The following list of minor parts cleaned in three-quarters of an hour:

200 each of brass washers, terminal and binding screws and terminal bushings.
50 each of jewel sleeve bushings and set screws, top bearings and set screws and light load adjustment screws.
100 each of register screws, back plate screws and light load plate retaining screws.

Some indication of the efficiency of chemical cleaning is given in the accompanying pictures of partially cleaned meter parts.

Glassware

For cleaning glass meter covers a mild alkali solution, a proprietary solution (name furnished on request), gave very good results. Eight ounces of the solvent were used per gallon of water with the temperature maintained from 180 to 185 deg. F. To prevent leach spots and for best results covers should be completely immersed in the solution. For the average cover ten minutes of immersion should be sufficient to remove the paint and clean the glass. Avoid leaving the cover in the solution longer than necessary.

Two methods of rinsing glass covers proved effective, spraying and alkaline rinsing: (1) Spray requires use of a pressure spray (water main pressure). Covers should be removed from the primary solvent and while still wet placed over a hot spray rinse for about 30 seconds. Covers can then be removed and placed on a rack to dry. While drying they should be tilted to a 45 deg. angle to eliminate condensation inside the covers. (2) Free-rinsing alkalies, such as a 1 percent aqueous solution of tri-sodium phosphate or a 2 percent aqueous solution of sodium metasilicate, can be used where spray methods cannot be employed. Procedure is to immerse covers in hot water while still wet with the cleaning solution, then in the alkaline rinsing solution and from there to a final hot water rinse. Drying operation is the same as for the spraying procedure. Because of the force of the pressure spray this method is usually the more satisfactory. Covers may be left to air dry and still attain the lustre obtained only by hand wiping.

Metal Cleaning

Cleaning and brightening of metals presents a problem because each metal has its own peculiar characteristic. Deposits of grease, oil or insulating gums may generally be removed successfully by immersing parts in tetrachlorethylene (perchlorethylene), an excellent degreasing solvent which is non-inflammable and may be reclaimed by distillation. Paint and other foreign materials may be removed by dipping the metal parts in a mild alkaline solution followed by a water rinse. In some instances discoloration caused by long exposure may also be removed by this process. Alkaline solution should be restricted to materials made of metal or glass; fibre bases of test switches, etc., should not come in contact with an alkali.

Brightening

After preliminary cleaning, parts are ready for brightening treatment:

An effective brightening solution consists of 2 oz. red oil or acid oleic, 4 oz. acetone, 4 oz. tincture of green soap, 16 oz. aqua ammonia (28 percent), and 102 oz. of cold water. Prepare solution as follows: Mix 4 oz. acetone with 2 oz. oleic acid. Add 12 oz. cold water and mix. Mix 16 oz. of aqua ammonia with 90 oz. cold water. Stir, while adding the diluted aqua ammonia to the acetone-oleic acid solution. Add 4 oz. of tincture of green soap and mix well.

This solution should be kept cov-

ered when not in use and should not be used without proper ventilation because of its ammonia content. It is advisable to wear rubber gloves.

For best results brass, copper, nickel, chromium and highly finished metals should be cleaned individually. Material should be immersed in brightening solution and left until metal becomes bright (from ten to twenty minutes). Agitation speeds the reaction. With most bright metals, foam resulting from agitation produces a desirable sheen. Removal of parts from the solution should be done quickly. Articles should then be immersed in running cold water and followed by a hot water bath. They should then be blown off with compressed air and heated until dry. After this they should be given a final rinse in tetrachlorethylene. This procedure, with slight modifications, applies to the cleaning of all small meter parts, light load and lag plates, meter connection block parts and test switch parts.

Test switches, meter connection blocks and fuse blocks should be cleaned by following the same procedures as for brass and copper except that work should be brushed while it is soaking in the brightening solution. Brushing dislodges obstinate material and produces a bright sheen.

Aluminum Disks

If properly handled, aluminum disks can be cleaned with a hot alkaline solution; however, they should not be immersed in any cleaner having a high alkalinity content. A small cleaning brush should be wet with the solution and applied to the disks with a circular motion. Rinse material carefully after cleaning, first using a cold water bath and then finishing with a hot water bath. *It is imperative that aluminum disks remain in contact with the solution of alkali no longer than from five to six seconds.*

Discolored brass shafts and worm gears may be restored by applying the brightening solution with a small brush and rinsing them in cold, then hot water. After cleaning they should be blown off with compressed air and dried by heating. Finally, the parts should be immersed in tetrachlorethylene while brushing the worm gears and pivot holes, removed and heated until dry.

Aluminum Bases

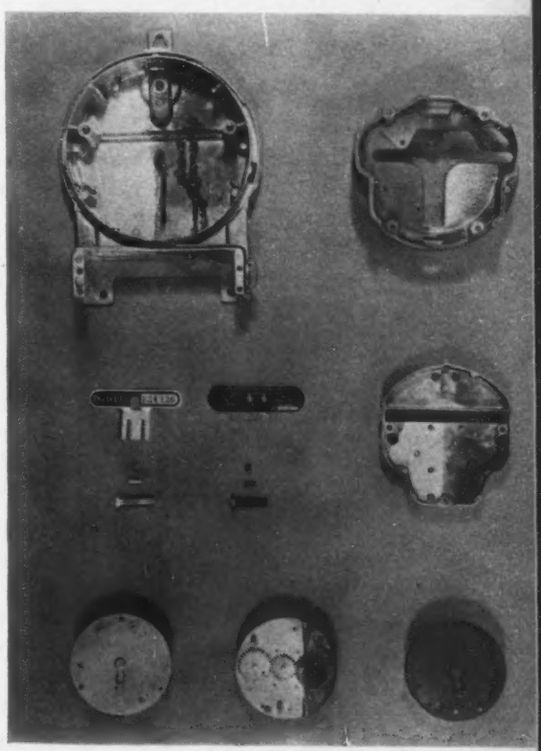
Aluminum bases should be cleaned as much as possible by brushing with tetrachlorethylene before performing the final cleaning operation. Bases are then ready to receive the alkali, which may be applied with a brush. Very little time (approximately fifteen seconds) is necessary to complete this operation. The work should be rinsed thoroughly by immersion in cold and hot water rinses, blown off with compressed air and allowed to dry by heating.

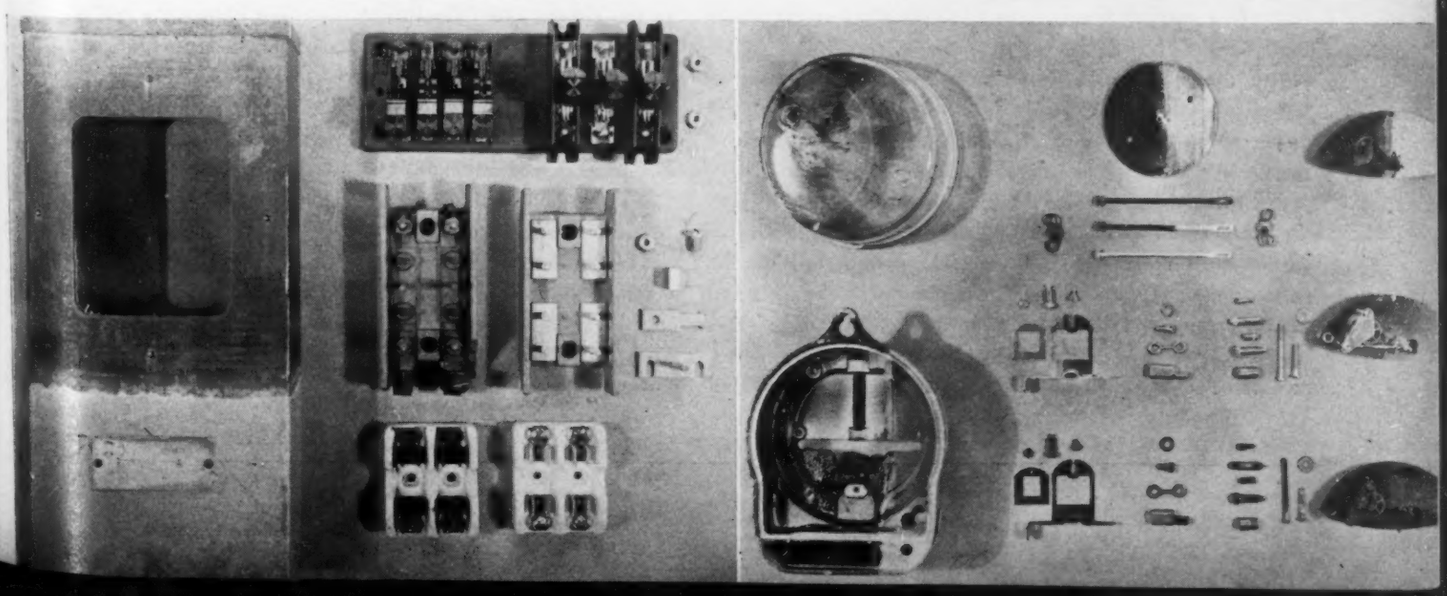
Caution must be used in cleaning aluminum sealing bars. They should not be allowed to remain in the alkali tank more than a few seconds. Follow immersion by a cold, then a hot water rinse, blown off with compressed air and allowed to dry. Bars covered with a heavy grease deposit can be degreased by immersion in tetrachlorethylene before cleaning; it aids the cleaning reaction.

Such parts as steel and iron bases, sub-bases, terminal covers, backplates, cover wing nuts and outdoor boxes are covered with a protective coating of varnish, lacquer or paint. After exposure to internal or external fire the problem of removing all traces of odor can be solved by stripping the protective coating and cleaning the pores of the metal. Place material to be stripped in a hot solution of alkali until clean. Time varies with the type of coating, from fifteen minutes to six hours. Articles are rinsed with a cold, then a hot water bath. To insure against rusting, a final rinse of sodium carbonate (soda ash) solution (approximately one tablespoon per six gallons of water) is best. Surfaces are blown off and heated until dry.

Cleaning procedures for discolored, burnt or dirty registers removed from meters subjected to internal fire or intense heat vary with the degree of burn and the base metal. For dial

[*Continued on page 135*]





DISMANTLED meter parts, some only partially cleaned, show efficiency of chemical cleaning methods on all types

Editorials

S. B. WILLIAMS, *Editor*

Does Defense Emergency Modify Investment Prudence?

SOME INTERESTING speculations have been going on regarding long-term orders for new capacity. If for some reason the war should come to an end shortly there is little likelihood that the additional capacity would be immediately necessary. What should be done? Would it be best to defer installation until some later date when the load has recovered, or should the scheduled installation program be carried out? How will the investment in either case be paid for?

The prudent investment theory as laid down by FPC in the recent State Line case offers no guidance except with respect to deferred investment. Any costs (taxes and interest primarily) incurred in carrying partially completed capacity while the remainder is being deferred would not be permitted in capital expense. On the other hand, it might be much more prudent to defer the unexpended investment, which would only be idle upon completion, until required. If completed, there would be taxes and interest each year. Would utilities be permitted to collect such sums from the customers on property not used or useful in rendering service at that time or would such expenses be considered losses that would have to be suffered by the stockholders?

This entire matter of prudence of investment under the lash of war is of great practical interest. The matter of getting enough business to keep plant in use is a risk that stockholders of every enterprise must take. When regulation, however, adds to that risk the uncertainty of being allowed not a return on the new investment but not even its carrying charges it isn't a very attractive picture for a prospective stockholder.

Under conditions of national emergency no operating executive can use normal prudence in the matter of adding capacity. If he is in a defense production area he cannot take a chance on being caught short. He must add capacity and that is what he is doing. Moreover, this operating executive has been urged, in fact almost pushed, into making commitments by the Federal Power Commission, the very agency which is advocating the prudent investment theory.

Now, there may be nothing contradictory in this apparent dilemma. FPC might easily take the position that in times of national emergency the prudent thing is to insure sufficient power for defense production this year and next year and the year after. It might decide that even if the new investment is never used it was put up in good faith and therefore must be paid for by the customers.

There is nothing, however, in any FPC statements or decisions that would point to such policy. It is well known that judicial bodies will not make decisions on hypothetical cases. Quasi-judicial bodies, on the other hand, that in themselves are judge, jury and prosecutor can make explanations that will have sufficient force to enable them to be used as guides.

If FPC decides one way the industry might go ahead with its own financing but if it decides another way then perhaps the only reasonable action is to seek government financing on the same basis extended to industrials, namely, option to buy from government at some later date. The industry is entitled to a statement from FPC on this matter right soon.

Fluorescent Certification Should be Encouraged

FOR a three-year-old industry it is remarkable the progress that fluorescent lighting has made not only in growth but in improved application. Every new idea that catches the public fancy apparently has to go through a period of opportunism when everybody down to the janitor takes a whirl at it. The natural result is that improper design and poor performance follow. A lot of this has occurred with fluorescent but it is finding its way out of trouble more quickly than many other new industries.

What has impressed us most is the acceleration of the certification programs, both RLM and Fleur-O-Lier. This year the output of tubes will probably exceed 20 million. After accounting for a small percentage of replacements it appears that approximately 5 to 6 million new lighting equipments will be needed to take care of this production. The certification programs are now going at the annual rate of half a million and before the end of this year that rate may have stepped up to three-quarters of a million.

Even if these estimates are not fully sustained, it is apparent that even now at least 10 percent of fluorescent equipments are certified. Considering that the first certified equipments came on the market approximately a year ago this seems like real progress.

Great credit is due the fixture manufacturers, for certification is not easy to get. This does not mean that the specifications are exceptionally difficult to meet. The problem has been in working with a new light source, new design and a number of accessories that have to be

fitted together properly. It would have been easy for the manufacturers to have gotten discouraged but instead they are offering more models.

This should be encouraged by the utilities. Certified fixtures will give the customer a comfortable lighting job and a minimum of maintenance difficulty. In spite of the fact that there are non-certified fixtures on the market which are unquestionably every bit as well designed as those that are entitled to carry the label, by recommending in fluorescent lighting sales presentations as a general proposition the use of certified equipments, or their equivalents, utilities can save themselves a lot of future grief as well as have more satisfied customers.

No Blame Attaches When the Public Understands

THERE is a lesson to be learned from the Eastern seaboard oil and gasoline shortage fiasco which may stand the utilities in good stead some day before long. Nobody has blamed the oil companies or the gas stations. All of the blame has centered on Mr. Ickes.

If there should come need for any power rationing the public is going to be very sore at the power companies unless the people understand that the fault does not lie with the utilities. There is less likelihood that consumers will find fault with utilities because of the growing difficulty in getting certain appliances, but the public isn't going to be any too happy about it.

Before any trouble should occur the local utilities have the opportunity to tell their public what they are doing to help along the defense program and how well they are equipped to handle the local load provided the government doesn't throw some extraordinary burden on them. It would be well to tell of some of the problems of getting materials and of the delays. Then, if rationing of power is put into effect, the public will know that no blame rests on their local power company.

In fact, these days provide the power companies with the opportunity to build back in public opinion. It is possible, with the right kind of public information, for utilities to come out of this emergency stronger than when they entered it.

A Rating Scheme for Dealer Protection

THE SQUEEZE is on for electrical appliances. Somebody is going to be left out. Who?

For years the power companies have been building up dealer distribution. They have wet nursed dealers to the point even of doing a large part of the selling and then delivering the orders on a platter. On the whole it has been worth while but nevertheless it represents a lot of time, effort and money. Will this dealer organization break down during the emergency period?

In spite of all the publicity it is doubtful that the government will go to the extremes predicted and put thousands of small dealers out of business. There will be a substantial volume of appliances available. It will be very much less, of course, than the production rate during the first three quarters of this year but compared with five or six years ago it may not look so bad.

Nevertheless, there will be some pinching of inventory and under such conditions the process of weeding out of dealers will occur. Who will fall by the wayside? Will it be solely because of insufficient stocks or will it be because that particular dealer is not a sales builder? This the utility can in a measure determine if it will grade its dealers according to the way in which they measure up to their local opportunities, regardless of size.

Such a rating system naturally should be confidential but with it a utility could through its own stock or influence do much to save the dealers that contribute soundly to the company's load-building program and leave the hangers-on to get along the best they can.

Another Tax Separation Champion

FOLLOWING closely on the heels of the Massachusetts Department of Public Utilities' decision this spring refusing to allow an automatic tax clause comes the permission of the Oregon commission to the setting up of a two-part bill—one part for electric service and the other a fixed percentage of this amount for taxes. This percentage is the ratio of the company's taxes to operating incomes.

Oregon does not in this way give its utilities an automatic adjustment for taxes because its approval must be secured each year that a revision is needed.

Here we have the two extremes: One commission insisting on a formal filing for schedule revision made necessary by higher taxes, the other recognizing the tax situation for what it is and making it easy for the utilities to act as tax collectors without penalty.

Coal clauses were necessarily automatic in their adjustment because of the element of time. Tax revisions, on the other hand, are annual, so that there can be no hardship in securing commission approval where adjustments are needed. Likewise, since the commissions give up none of their statuatory powers we would expect, on the grounds of reasonableness alone, that more and more commissions will follow the lead of Oregon rather than that of Massachusetts.

So far the indications are that few utilities have made formal application for permission for two-part billing, and until they do the commissions are not likely to believe that the burden is too severe. Until a formal separation is made and a service rate less taxes established there can be no relief from increasing taxes short of rate revision.

Since it is evident that taxes are going to be appreciably higher next year it might be good policy to effect that separation now.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Staff

Utility Expansion Now Under Priority Control

PROJECT PRIORITY RATINGS for utility construction work are now available through OPM's power unit. No formal plan has been issued by the Priorities Division. Probably won't be, except for the likely release of rules for making application and standard forms to facilitate handling.

Utilities can get a project rating by writing to J. A. Krug, OPM's power coordinator. Give him details of the proposed construction and specific reasons why the work is considered necessary, the kind and amount of materials it will require, the assembly schedule for delivery of parts, and the final completion date. Application may be made both on construction work starting in the immediate future—even that now underway—or on jobs planned for next year, the year after, and later. The exigencies of metal supplies soon will make it necessary, if it isn't already, that all utility construction have ratings. Without a place in the priority schedule, materials simply won't be available. A project is defined as expansion of generating capacity, transmission lines, extension of distribution system—in short, all new construction work.

Upon receipt of an application for project rating, the power unit first decides whether the construction should be undertaken, and at the time and in the manner proposed. If the project contemplates additional capacity, approval is reasonably certain although in some instances, Krug's office may suggest advancing or retarding the date of installation. If it is extension of a line to a defense housing project, or a defense plant, approval will be next to certain. If it involves extending a distribution system into a new real estate development—well, it must take its chances on its merits.

The assembly schedule for delivery of parts and equipment also will be studied, and perhaps modified. Washington is dead set against anticipatory deliveries and advance buying—there has been, officials feel, too much of this in the defense program so far, both by industry and by the Army and Navy. Donald M. Nelson, now No. 1 man in the defense set-up, is out to put a halt to the practice, wherever it is found. So, to stand in good with Washington, don't order transformers for delivery six months ahead of the generator for which they are needed.

A Second Look

Projects needing an allocation of materials back in the production line now or in the near future will get a high rating depending somewhat upon their urgency. Projects in the future —generator installations for 1944 and 1945 or line construction for next year—may be rated no higher than B-2. This means that the work gets a place in the manufacturers' schedules, its date okayed. Later, as the time draws near for starting the process of producing and assembling the various components, a higher rating as required by then existing circumstances will be applied.

This system, in effect, gives the OPM power coordinator and his staff a "second look" later in the game. It doesn't mean that that office may withdraw its approval of a project, where a utility has made commitments. But it does mean that a maturing project in one area may be pushed back to make room for one which a later more urgent need has developed.

From another point of view, the relative level of a project rating for work to be undertaken in the future is less important. Priority control has been exercised from both the top and the bottom almost since the outset—at the top by giving certificate ratings for completed items, at the bottom by allocation of supplies of raw materials to processors. Theoretically, these two channels should meet. Actually they don't. The reason is that there have been too many "scraps of paper", issued too loosely and without an adequate knowledge of this cumulative effect upon supply at any given time.

Allocation is rapidly becoming the real point of government control over raw materials of which there isn't enough to go around. Rating certificates are becoming secondary, a guide from which to make allocations but not necessarily a controling guide. All of the raw materials allocation orders specifically permit Director of Priority Nelson to make allocations in conflict with priority certificates, to direct the use of a raw material for an unrated purpose at the expense of one with a rating.

Real control, then, lies in the parcelling out of the raw materials, the copper, steel, aluminum, zinc, etc. As this end of priority control becomes more and more dominant, Krug expects to fit it into the picture for channeling supplies to utilities. Manufacturers will get their raw materials through allocation to fill specific orders or to make specific things.

Where allocations amount to virtual capacity production—as with generators, for instance—the individual rating held by a particular utility for a particular generator will be of little importance. So long as the number of ratings outstanding do not exceed the capacity to produce from the stock of materials made available to manufacturers, all orders will be filled on time.

Of course this means full and complete government control over the expansion of utility operations for the duration of the war. This is inevitable, regardless of what priority system develops because the demands for munitions and maintenance of a minimum civilian economy require husbanding of the available resources. Mr. Krug has stated that the most effective way to do the job which must be done is to work with the existing facilities, both public and private, strengthening and expanding those now providing service to essential productions.

NEWS OF THE WEEK

First 60,000-Kw. Turbine at Lake Shore on Line

Cleveland Electric Illuminating Company starts up first of two turbo-generators as part of $13,000,000 program principally to provide for national defense needs

The Cleveland Electric Illuminating Co. last Friday put into operation for the first time its new Lake Shore power plant, on Lake Front road near East 70th street. Construction of the plant, which was started April 1, 1940, took 17 months, 11 days and operation began four days ahead of schedule.

The initial installation in the new plant comprises two Babcock & Wilcox boilers, with steam generating capacity for the operation of two 1,800 r.p.m. 60,000-kw. General Electric turbo-generators with dependable capacity of 72,000 kw. each, or a total of 144,000 kw. and operating at 850 psi. and 900 deg. The first of these turbo-generators is now in operation after successful testing operations. The second turbo-generator is under construction and will be installed next year.

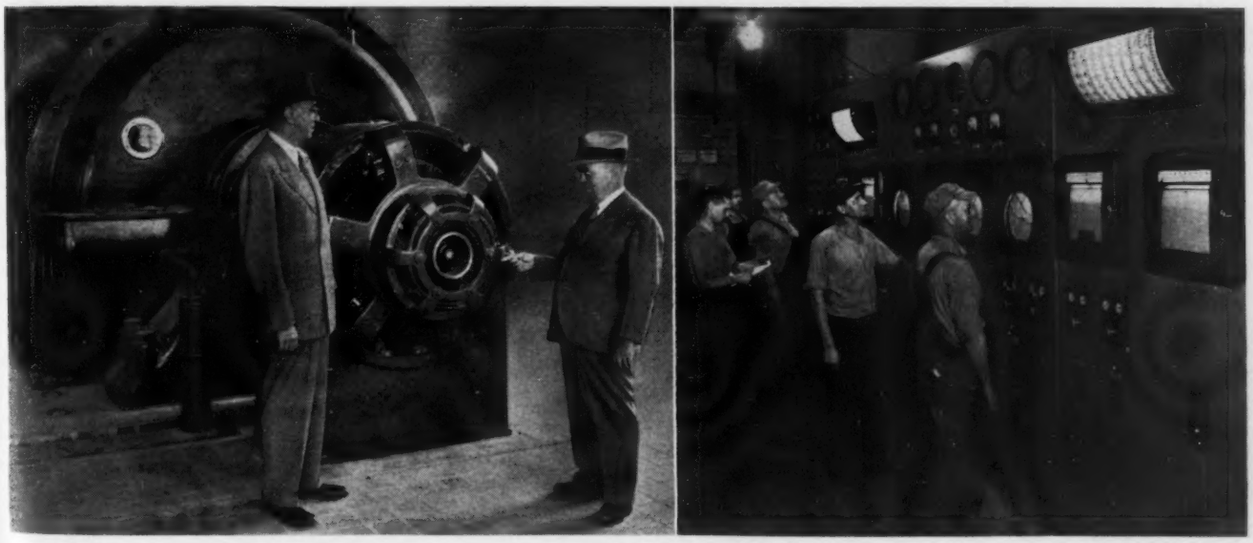
The company also has under construction a 50,000-kw. General Electric turbo-generator, which will be installed in an addition to its Avon power plant in 1943. This turbo-generator will have a dependable capacity of 60,000 kw.

These additions to the company's power plant facilities are being made very largely to meet anticipated demands for industrial production for national defense. This year the company is expending a total of more than $13,000,000 for additions to generating, transmission and distribution facilities, most of which is to provide electric energy for national defense uses.

Cost of the new Lake Shore power plant, as it went into initial operation last week with one turbo-generator, was $6,300,000. Cost of the installation of the second turbo-generator at this power plant will be $1,900,000, bringing the total cost of the new plant to $8,200,000.

The estimated cost of the addition to the Avon power plant, which will be built entirely for national defense production, is estimated at $3,500,000.

At 11 a.m. Wednesday of last week, the company's system recorded a record maximum peak load of 536,882 kw. On the same day, the company's system also recorded a record maximum 24-hour output of 8,895,489 kw.-hr.



MEMBERS of the operating staff (right) of the Cleveland Electric Illuminating Co.'s new Lake Shore power plant watch gages and recording instruments during testing of the turbo-generator preliminary to its being put into production. At left, Eben G. Crawford, utility president (left), and Guy E. Conkey, president of Hunkin-Conkey Construction Co., general contractors on the project, watch the exciter of the turbo-generator as it comes up to full speed of 1,800 r.p.m.

With the new Lake Shore unit in operation the company's system has a total dependable generating capacity of 667,000 kw. With the installation of the second turbo-generator at the new Lake Shore station, and with the addition to the Avon power plant, the company in 1943 will have a total dependable generating capacity of 799,000 kw.

The Lake Shore power plant incorporates the most advanced developments in engineering design. Architecturally, the building is modern in its lines, and the use of a considerable amount of glass block in the walls contributes to its distinctive appearance. On the interior special attention has been paid to a color scheme and lighting equipment to provide the best possible seeing conditions for efficient operation. A feature of the plant is its Cottrell electrostatic precipitator equipment for the abatement of smoke.

In a plant of this type, it takes slightly less than one pound of coal to produce one kilowatt-hour of electricity.

For condensing purposes the plant will use 320,000,000 gallons of Lake Erie water per day, bringing the total use of condensing water by the company's combined Lake Shore power plants to 800,000,000 gallons of water per day.

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Asks $40,000,000 to Expand TVA Plants

This week President Roosevelt asked Congress to appropriate $40,000,000 to expand the facilities of TVA to meet the increased demands of defense industries.

At the same time it was announced that David E. Lilienthal had been designated chairman of the board of directors of TVA succeeding Dr. H. A. Morgan who becomes vice-chairman of the board.

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Independent Union Wins in Louisville Election

Production and maintenance workers of Louisville Gas & Electric Co. cast 782 votes in favor of the Independent Protective Association of Utility Workers in an all-day election held under the auspices of N.L.R.B. which declared the association to be sole bargaining agent.

The A. F. of L.'s Brotherhood of Electrical Workers received 288 votes and fourteen employees voted for neither group.

Official ballot boxes and booths were borrowed from county officials.

Appliance Service Plan to Stimulate Repairs

Separate company, suggested by Consolidated Edison, to propose standard schedule of charges, offers greater inducement for servicing, and revenue-recovery effect for utility.

Three important angles of the electrical appliance business will move nearer to solution under the new appliance repair and maintenance plan developed by Consolidated Edison System companies for presentation to electrical appliance distributors, manufacturers and service and repair companies last week.

A separate company to be established under the sponsorship of Consolidated Edison would first standardize upon repair charges thereby inducing customers to restore appliances more quickly to service. Secondly, appliances which were restored to service would again begin using kw.-hr. and would recover lost revenue for the utility. Thirdly, any new development which facilitated repair work on appliances would be in a position to take advantage of the current situation on priorities whereby repair parts for appliances enjoy priority advantages over parts for new appliances.

Separate Staff

Present plans are for the new company to have its own officers and policies and to be established by a board of governors. The board comprises representatives of manufacturers of refrigerators, ranges, heating equipment, radios and miscellaneous small appliances, representatives of distributors and dealers in each of the city's boroughs and representatives of the utility company.

Customers with appliances in need of servicing or repair parts would contact the shops of cooperating dealers or repair counters in utility showrooms where lists of standard prices for all ordinary repairs would be available for reference and discussion. If the work to be done was not included on the lists, those accepting the work would be obliged to settle upon a price with the customer before the work was undertaken.

The dealer would operate as a receiving center for appliances, and a pick-up and delivery service would be operated from the dealers to a central servicing station.

At the service station it is planned to repair appliances under careful supervision; when the work is completed, and the work has been inspected and tested, a tag of certification, with the cost of the repair work perforated thereon, would be attached for the customer.

It is proposed that repairs could be paid for on a time payment basis extending up to 6 months with minimum

RECENTLY DEDICATED was this new combination power plant, central office, display room, directors room, warehouse and garage of Tri-County Electric Cooperative of Portland, Mich. Plant is designed for five diesel engines, generators and auxiliaries. Now installed are two Cooper-Bessemer, eight-cylinder engines rated at 688 hp. each at 400 r.p.m. and driving 493 kw. generators. The new plant, dedicated to REA's Clarence A. Winder is part of a system serving 5000 customers located in thirteen counties

charge of one dollar monthly. For his part in the transaction, the dealer would receive a commission on each appliance originally brought to him for repair work.

Anticipated Benefits

The plan is expected to result in standardized, uniform, known-in-advance charges for the advantage of the customer, it was said, and the operation of a central servicing plant should result in faster service, better service and increased efficiency which would be reflected in prices charged for repairs. Further, any system or procedure which provided for guaranteed or certified repairs at relatively economical prices would lead to a greater disposition to have appliances repaired with the result that more revenue would be restored to the companies.

The importance of these new proposals to repair appliances on a more systematized basis was emphasized this week by reports of curtailed sales efforts with respect to new appliances due in turn to expectations of curtailed production of appliances.

One distributor of appliances is reported to have greatly reduced his advertising activities in the metropolitan area principally in connection with cooperative advertising through dealers.

Another company, representing a second type of curtailment, plans to maintain its own sales force intact by discontinuing its present distributor and handling its own distribution.

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Chemists Plan to Cut Power Shortage

A new chemical process for manufacturing chlorine and salt cake from salt and sulphur without the use of electric power was reported last week by Prof. Arthur W. Hixon and Dr. Alvah H. Tenney, chemical engineers of Columbia University at the Autumn meeting of the American Chemical Society at Atlantic City, N. J.

The new process, it was reported, would free millions of kilowatts of generating capacity for the production of aluminum and other strategic defense materials.

The new process is expected to avert shortages in chlorine and sodium sulphate (salt cake) and to make the United States self-sufficient, as 40 percent of this country's industrial usage of sodium sulphate has heretofore been imported from Germany.

Normal peacetime uses of chlorine have been superseded by tremendous expansion in needs for chlorine in the development of plastics, synthetic materials and organic chemicals.

Blanket A-10 Priorities for Maintenance—Repairs

Utilities given fully-automatic, blanket A-10 rating for maintenance, repairs, and operating material. New connections to distribution system, overload corrections and minor additions allowed

Utilities this week were given a blanket A-10 priority rating to obtain supplies of maintenance, repair and certain operating material necessary to maintain uninterrupted service and to connect new customers to their existing distribution systems. Use of the rating is fully automatic, but utilities must formally notify OPM's power unit on Form P-46 of their acceptance of the order's regulations and their intention to use it.

Eligible to use the A-10 rating are electric, gas (natural and manufactured), water, public sanitation and central steam heating utilities. Once formal acceptance is made, a duly designated officer of each utility simply endorses qualified orders for repair, maintenance and operating supplies with this statement:

"Purchase order for utilities operation, maintenance and repair, preference rating A-10, pursuant to priorities division order P-46."

Suppliers may also self-assign the A-10 rating to their own orders for materials with which to fill contracts from utilities carrying the rating. Neither utilities nor suppliers are permitted to use the rating, however, to obtain deliveries in greater quantities or on dates earlier than required, or unless the materials cannot be obtained without priority aid.

Official definitions in the order of repair, maintenance and operating supplies are: "Repair," means the restoration of a utility property to a sound working condition after wear and tear, damage, destruction of parts, or the like, have made such properties or equipment unfit or unsafe for service; "Maintenance," means the upkeep of property and equipment in sound working condition; "Operating supplies," means any material which is essential to operation and which is generally carried in utilities' stores and charged to operating expense accounts.

The order specifies that the term operating supplies does cover materials used for connecting new consumers to the general lowest pressure or lowest potential system of the utility, and for relief from serious overload and other minor capital additions. It specifies, however, that none of these three terms can be used to obtain materials for improvement of property or equipment through replacement of still usable material with material of a better kind, quality or design, nor for additions to, or expansion of property or equipment. A project priority must be obtained for capital improvements.

Several detailed restrictions on deliveries, withdrawals and inventory levels are contained in the order. Utilities may not, during any calendar quarterly period, accept deliveries (rated or unrated) of repair, maintenance or operating supplies in dollar volume exceeding 25 percent of withdrawals of similar items from stores or inventory in all 1940.

Utilities may not accept deliveries of such materials at any time until inventory and stores of such materials have been reduced to "a practical working minimum." This minimum, in no case, may exceed the dollar value of such materials on hand as of December 31, 1940. Utilities may not, during any calendar quarterly period, withdraw from stocks or inventory materials whose dollar value exceeds either the comparable 1940 quarter or 25 percent of total 1940 withdrawals, at the utilities' option.

A final limitation paragraph provides that, nothwithstanding the three limiting provisions outlined above, utilities are permitted in any calendar quarter to increase the aggregate dollar volume of deliveries, withdrawals or inventory of operating supplies over the aggregate dollar volume of the preceding quarter proportionately to the increase of the system output for services in the field for which the supplies are used.

Intent of these limiting paragraphs is, first, to restrict use of the A-10 rating to the 1940 levels and, second, to permit increases over this level in the future for operating supplies in proportion to the growth of demand.

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Retain Daylight Saving

Daylight saving time will be continued during the coming winter months in the provinces of Quebec and Ontario, H. J. Symington, K. C., power controller for Canada, recently stated. "We need the power more than ever before," he said. "By keeping the clocks ahead an hour we saved 140,000 hp. last winter in the two provinces," Mr. Symington said.

$150,000,000 of RFC Funds for Utilities

The Reconstruction Finance Corp. has earmarked $150,000,000 for assisting utilities in financing additional generating and transmission facilities which the Federal Power Commission and OPM's Power Unit recommend for installation, mostly in 1943, to serve growing war loads.

Formal announcement of plans for using the fund to develop additional energy throughout the nation probably will come within two or three weeks. Disclosure that the money has been earmarked came in RFC's periodic report to Congress this week of its disbursements and allocations. The report lists the money as being assigned to FPC, "for power development".

The allocation provides FPC, working jointly with the OPM office of J. A. Krug, power coordinator, funds with which to facilitate the financing of additional capacity in areas where defense officials anticipate abnormal load growths beyond the programmed capacity of utility systems. It is understood that manufacturers are being asked to arrange for expansion of the generator production capacity to handle most of the orders for 1943 delivery.

As much of the money as necessary will be used to finance generating capacity and transmission lines, but none of it will be used for financing the added industrial capacity which may be necessary.

Initiative in this program will come from Washington. Wherever the Krug office and FPC agree that the defense program is likely to develop loads beyond the capacity, less reserves, of operating utilities to serve, utility officials will be informed and asked to order additional equipment. They will be offered use of the RFC money if this would be of any help to them, their project geared into manufacturers' schedules and given a high project priority rating to insure promptest delivery and installation.

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New Officers for Associated Units

Trustees of Associated Gas & Electric Corporation last week took further steps to set up separate managements for its top sub-holding companies with a view to fixing responsibility for the conduct of the affairs of the sub-holding companies.

Directors of NY-PA-NJ Utilities Company elected Willard L. Thorp, one of the trustees of Associated Gas & Electric Corporation, as president and Ernest J. Howe vice-president. Mr. Howe in his new capacity will be responsible for the affairs of NY-PA-NJ.

The board of General Gas & Electric Corporation elected H. K. Halligan vice-president with primary responsibility for operations of that company. Directors of United Coach Co. elected F. N. Polangin as president and Arthur Cano as vice-president.

New officers involved in the changes were selected from present personnel of the trustees, the sub-holding companies and Atlantic Utility Service Corporation, trustees said.

"The changes mark a further forward step in the reorganization proceedings," the trustees stated, "not only in compliance with the holding company act but in showing that our problems are now so delineated as to permit a more exact designation of responsibility."

NEWS BRIEFS

ELECTRIC SERVICE in Kansas City, Mo., was halted for four hours Tuesday night when a surprise strike was called by a local of the A.F. of L. International Brotherhood of Electrical Workers. The strike affected 400,000 persons, hospitals were without service, city water supply was stopped and street cars and electric buses were halted.

ONLY SEVENTEEN out of 31 presidents of the United States ever saw an incandescent lamp, according to a Narragansett Electric Co. window display of miniature statues of the nation's chief executives which drew capacity sidewalk crowds at the Providence headquarters of that utility.

NEBRASKA POWER Company after preparing and issuing its standard 1940 Annual Report for Stockholders, made up a second 1940 Annual Report expressly for employees. The latter contains a resumé of financial facts in simplified form and summarizes company facts and forecasts of particular interest to all employees.

NEW YORK TELEPHONE Company linemen have a cure for wasp trouble. Linemen who found telephone terminal boxes filled with wasps have discovered that they can get the wasps to move out by hanging a small bag of moth balls in each box.

SAMUEL T. MACQUARRIE of the Boston Edison Co. has been named chairman of a Massachusetts Industries Committee to sell defense savings bonds through payroll deductions, at the request of the U. S. Treasury.

OPM's Power Staff Now Numbers Sixteen

The staff of OPM's Power Unit, headed by J. A. Krug, on leave as TVA's manager of power, is growing. The staff now numbers 16, divided roughly into four divisions—priorities, production and transmission, requirements, and statistical and legal.

Dr. John C. Parker, Consolidated Edison Co., is chief priorities specialist, assisted by Frederick Schaff, Superheater Co.; Harry W. Scott, Union Electric Co.; William Zepp, OPM's Priorities Division liaison; and Manley Goodyear, priorities attorney. Mr. Schaff also handles combustion problems.

J. E. Moore, Ebasco Services, Inc., and W. S. Peterson, Los Angeles Power & Light Bureau, are assigned to production and transmission matters, with Sol Schultz, chief engineer of the Bonneville Power Administration, as special assistant for the Northwest. Edward Falk, Consolidated Edison Co., and Constantine Barry, Philadelphia Electric, work with George Buck and Walter Caine of the Federal Power Commission staff on power requirements data.

Willis J. Spaulding, superintendent of the Springfield, Ill., municipal plant, is the newest staff member, taken on to handle municipal plant matters and assist in priorities. Chief statistician for the unit is Barkley Sickler of Bonneville and Herbert Marks, formerly of Bonneville, is the unit attorney. Mr. Marks is on the staff of John Lord O'Brian, chief counsel for OPM who, because of his keen interest in utility matters, also frequently consults with the unit on legal matters.

In the administrative scheme of things, Mr. Krug's office reports to OPM through the Materials Division headed by W. L. Batt, Sr.

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St. Louis Drawing On Reserve Capacity

That the Union Electric Co. of Missouri is drawing heavily upon its reserves to supply the expanding power need in the St. Louis area for defense production was the burden of a talk delivered to the recent meeting of the American Society of Mechanical Engineers by Dr. William McClellan, president of the utility.

"Today, we are selling the production of a large part of our reserve," Dr. McClellan said. "In meeting the increased demands, Union Electric has had to call on every bit of machinery we have, some of it 22 to 25 years old. Just what would happen if one of our

large units broke down now, I don't know, but I think we would pull through by the skin of our teeth. We have plenty of water this year at Keokuk and at Bagnell Dam."

The utility president said much of the defense effort had piled up on the utility industry. He explained that in every defense plant being built there is great demand for power and yet the electric company that must supply that demand seldom knows in advance what it will be.

In 1939, Dr. McClellan said, the peak load of the Company was 476,000 kw. It was estimated the load would increase 5 or 6 percent a year at that time, and the requirement by late 1941 would be about 540,000 kw. of capacity for the system.

Added Demands

The sudden development of the defense program has thrown 1939 estimates entirely out of line, Dr. McClellan pointed out and the estimate now is 640,000 kw. of demand for the late fall of 1941, 730,000 kw. for 1942 and if the present rate of defense production in the St. Louis area continues, the electrical demand will be about 790,000 kw. by 1943. The estimate of defense orders in the area has grown from $285,000,000 May 1 to $700,000,000 as of September 1.

To meet these estimates, Union Electric is building additional capacity of 240,000 kw. at its Venice No. 2 Plant, 40,000 kw. of which is expected to be ready by the first of the year, 40,000 kw. more by February 1, 1942, 80,000 kw. by late 1942 and a second 80,000 kw. by the fall of 1943.

•

Raver Urges New Dam for Columbia River

Paul J. Raver, Bonneville power administrator, has recommended to a Senate subcommittee that governmental agencies be implemented to assist small, as well as large, private and independent enterprises to develop western mineral resources.

Mr. Raver also urged that new appropriations totaling approximately $30,000,000 be made available immediately to prevent delays in the $66,000,000 Bonneville 1943 transmission construction program for supplying power to new western industries.

He further recommended that generator installations be speeded at Grand Coulee to permit the operation of fifteen units by March, 1945, and that construction of a new multiple-purpose dam on the Columbia River be undertaken as rapidly as possible.

Third Topping Turbine in Service at Waterside

Superposed 65,000-kw. unit for Consolidated Edison increases system generating capacity to 2,632,000 kw., operates at 1250 lb. and 925 deg. F. — Fourth 65,000-kw. turbine soon to go on line

One of the world's largest "topping turbines—a 65,000-kw. unit—has been placed in service at the Waterside generating station of Consolidated Edison Company of New York, Inc. This turbine, known as No. 6, is the third topping turbine to go to work at Waterside. A fourth machine of the same capacity, made by General Electric, is expected to go on the line within a short period. No. 6 brings the total generating capacity of Consolidated Edison System to 2,632,000 kw.

Large Capacity

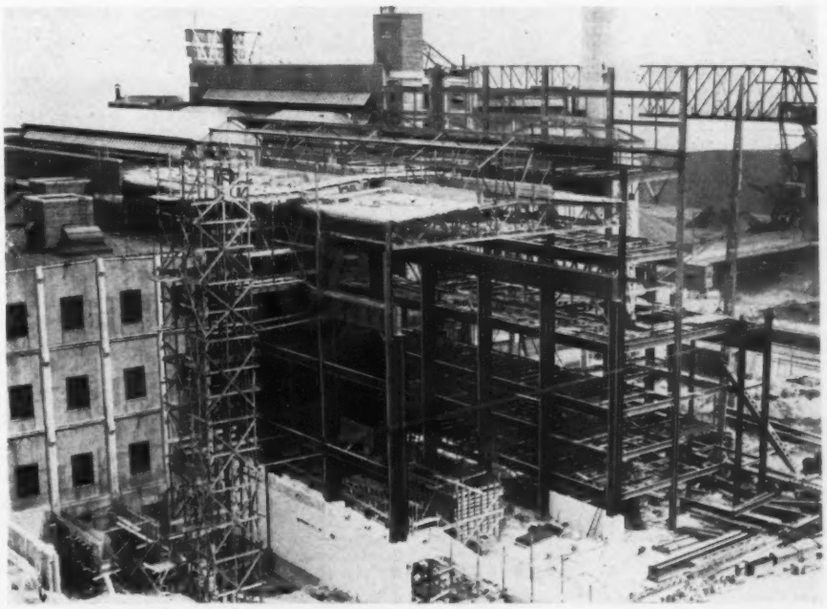
No. 6 is a Westinghouse machine, operating with a throttle steam pressure of 1,250 lb. per square inch and a temperature of 925 deg. F. Its capacity is 30 percent greater than either of the predecessor units installed at Waterside in 1937-38 and is one of the largest obtainable at present in a machine running 3,600 revolutions a minute. Its exhaust steam at 200 lb. pressure can be used to generate about 72,000 kw. in older units in the station, thus increasing the highest efficiency capacity of the system by 137,000 kw.

Steam for this generating unit is supplied by two Combustion Engineering Co. boilers, each having a capacity of 615,000 lb. of steam an hour, burning powdered coal. They are of an advanced design, having all the latest types of fuel-saving equipment, such as economizers and air pre-heaters. Combustion control is automatic. Temperature, pressure and other data are made readily available to operators by a set of indicating and recording instruments mounted on the boiler control boards.

Flue gases are thoroughly cleaned in Cottrell precipitators before being discharged to the stack.

900,000 kw. Reserve

With No. 6 in operation Consolidated Edison System's electric power reserve, which is the total generating capacity exceeding the peak load of 1940, amounts to more than 900,000 kw. This is considered to be an ample surplus to take care of any power demands which could arise in the territory in the next two years.



PORT WASHINGTON GROWS—Boiler and turbine room extension to house the second 80,000-kw., high-pressure unit for Port Washington station of Wisconsin Electric Power Co. is progressing rapidly. The addition, costing around $7,000,000, will double the present capacity of the plant and will be in operation during 1942

Plans to Sell 20,000 Kw. New Lighting Load

Philadelphia is starting on its fifth annual fall lighting campaign with a bogie of 20,000 kw. added load and $1,700,000 of equipment sales. These quotas which are twice the record 1940 achievement were disclosed at a dinner meeting this week of more than two hundred men from all branches of the industry.

This annual campaign has been under the direction of the lighting division of the Electrical Association of Philadelphia. Cash prizes for the best individual sales results in each of the selling groups: Contractors, wholesalers and utility, are sufficiently large to stimulate competition.

•

Maryland Association Holds Mid-Year Meet

Approximately 260 persons attended the mid-year meeting of the Maryland Utilities Association held on September 5 and 6 at the George Washington Hotel, Ocean City, Md.

On Saturday morning, September 6, a combined meeting of the transportation, gas and electric groups was held. Addresses were made by Chester W. Cambell, borough superintendent and acting chief of defense and disaster control, Department of Housing and Buildings, City of New York; Paul Merrick, Ohio Bell Telephone Co., and Larry F. Livingston, E. I. duPont de Nemours, Wilmington, Del.

An informal banquet was held on Saturday evening.

•

MKB's New Color Movie Now Ready for Showings

Electrical appliance dealers, distributors and salesmen, home economics experts and kitchen planning authorities extended an enthusiastic welcome to The Modern Kitchen Bureau's new full-color talking motion picture, "It Happened in the Kitchen," at the recent premier showing.

"It Happened in the Kitchen," a 40-minute Kodachrome talking movie, tells the story of all-electric kitchens. A practical plan book giving full details of the picture, and containing natural color photographs from "It Happened in the Kitchen," can be obtained from the Modern Kitchen Bureau, 420 Lexington Avenue, New York, N. Y.

•

Utility Raises Salaries

A general salary increase to its 1,600 employees who work in plants in several parts of the state, has been announced by the Jersey Central Power & Light Co., Asbury Park, N. J., through T. R. Crumley, president. The increase will be 5 per cent of present salaries and will amount to $150,000 yearly on the approximate $3,000,000 payrolls of the company.

MEETINGS

International Association of Electrical Inspectors—Eastern section, Mayflower Hotel, Washington, D. C., September 22-24. F. N. M. Squires, secretary, 85 John St., New York, N. Y.; southern section, McAllister Hotel, Miami, Fla., September 29-October 1. Joseph Whitner, secretary, P. O. Box 1743, Atlanta, Ga.

Illuminating Engineering Society—Annual convention, Atlanta-Biltmore Hotel, Atlanta, Ga., September 22-25. Frank G. Horton, executive secretary, 51 Madison Av., New York, N. Y.

Association of Iron and Steel Engineers—Annual convention, Cleveland Public Auditorium, Cleveland, Ohio, September 23-26. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Indiana Electric Association—Annual fall meeting French Lick Springs Hotel, French Lick, Ind., September 24-26. R. E. Bloosom, secretary, 1414 Circle Tower, Indianapolis, Ind.

Southeastern Electric Exchange—Engineering and operation section, Suwanee Hotel, St. Petersburg, Fla., September 25-26. J. W. Talley, executive secretary, 303 Haas-Howell Building, Atlanta, Ga.

Electrochemical Society—Fall meeting, Chicago, Ill., October 1-4. Colin G. Fink, secretary, Columbia University, New York, N. Y.

Edison Electric Institute—Meter and service committee, New Ocean House, Swampscott, Mass., October 2; prime movers committee, St. Louis, Mo., October 6-7; electrical equipment committee, Hotel Cleveland, Cleveland, Ohio, October 13-14; transmission and distribution committee, Netherland-Plaza Hotel, Cincinnati, Ohio, October 20-22. Col. H. S. Bennion, managing director, 420 Lexington Av., New York, N. Y.

Public Utilities Association of the Virginias—First annual convention, The Greenbrier, White Sulphur Springs, W. Va., October 3-4. A. Bliss McCrum, secretary, 612 Charleston National Bank Bldg., Charleston, W. Va.

National Electrical Contractors Association—Fall meeting, Rice Hotel, Houston, Tex., October 6-8. L. W. Davis, general manager, 420 Lexington Avenue, New York, N. Y.

National Safety Council—National Safety Congress and Exposition, Stevens Hotel, Chicago, Ill., October 6-10. W. H. Cameron, managing director, 20 North Wacker Drive, Chicago.

American Institute of Electrical Engineers—South West district, Coronado Hotel, St. Louis, Mo., October 8-10. H. H. Henline, national secretary, 29 West 39th St., New York, N. Y.

Commercial Electric Cooking Council—Fifth annual conference, Hotel Knickerbocker, Chicago, Ill., October 9.

Wisconsin Utilities Association—Electric section, Hotel Schroeder, Milwaukee, October 13-14. A. F. Herwig, executive secretary, Room 502, Brunder Bldg., 135 West Wells St., Milwaukee, Wis.

American Society of Mechanical Engineers—Fall meeting, Louisville, Ky., October 13-15. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

National Electrical Wholesalers Association—Semi-annual convention, Hotel Statler, Detroit, Mich., October 14-17. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

American Welding Society—Annual meeting in conjunction with National Metal Exposition, Bellevue Stratford Hotel, Philadelphia, Pa., October 19-24. Miss M. Kelly, secretary, 29 West 39th St., New York, N. Y.

National Electrical Manufacturers Association—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 27-31. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

National Research Council—Conference on Electrical Insulation, annual meeting, Williamsburg, Va., October 30-November 1. Thorstein Larsen, secretary, Consolidated Edison Co. of New York, 55 Johnson Street, Brooklyn, N. Y.

Peterson Addresses Accounting Section

"Utility management has become more public minded during recent years and has accepted in greater measure its responsibility toward the public holders of utility securities", Chairman R. W. Peterson, of the Wisconsin Public Service Commission, declared last week before the annual accounting section of the Wisconsin Utilities Association in convention at Green Lake, Wis.

Commissioner Peterson traced this condition in part to the lessening of holding company control of managerial policies and an attendant increase in authority given to operating utility officials.

Speaking before more than 100 accounting executives of Wisconsin's electric, gas and transportation utilities, the Wisconsin Commissioner summarized the many benefits accruing from more informative accounting systems now prescribed and from rules of the SEC regarding full disclosure of facts.

Mr. Peterson pointed out that improvements in accounting for depreciation of property and the building of proper depreciation reserves will aid in establishing and maintaining utilities in sound financial conditions and improve the quality of their outstanding securities. Monies retained in the business by reason of the depreciation reserves are available for plant addition or debt retirement, he indicated.

They tend to reduce the amount of outside financing required and thereby reduce the cost of capital to the utilities.

"In the long run", Peterson stated "this condition should benefit the investor by making the return on capital obligations more certain and the customer should benefit because the total amount required to pay interest and dividends is reduced."

•

Home Economists Meet

The first two-day conference of utility company home service directors and home economists was held recently at the auditorium of the Electrical and Gas Association of New York, Inc., under the auspices of the home service committee of the Edison Electric Institute. More than 250 guests heard the importance of the functions of the home economists emphasized, saw the newest ideas for demonstration of all types of appliances for cooking and lighting applications, and learned the latest facts just developing in the National Nutrition Program, menu planning and the preparing of nutritious meals from limited food varieties.

Electrical Output Recovers Trend

During the week of September 13, 1941, net energy for distribution, according to an announcement made by the Edison Electric Institute, amounted to 3,281,290,000 kw.-hr., an increase of 18.3 percent over the corresponding week in 1940, thereby recovering the increasing trend noted before the Labor Day holidays.

The rate of increase reported a year ago in the post-Labor-Day week was 9.5 percent or 241,163,000 kw.-hr. above the corresponding 1939 figure of 2,532,014,000 kw.-hr. so the increase in output this year is noteworthy.

This week again the Southern States regional group leads the list of geographic division changes with 27.1 percent increase compared to 27.4 percent last week.

Next in order appear the New England and the central industrial divisions with increases of 19.6 percent for each. Mid-Atlantic States output increased 16.1 percent.

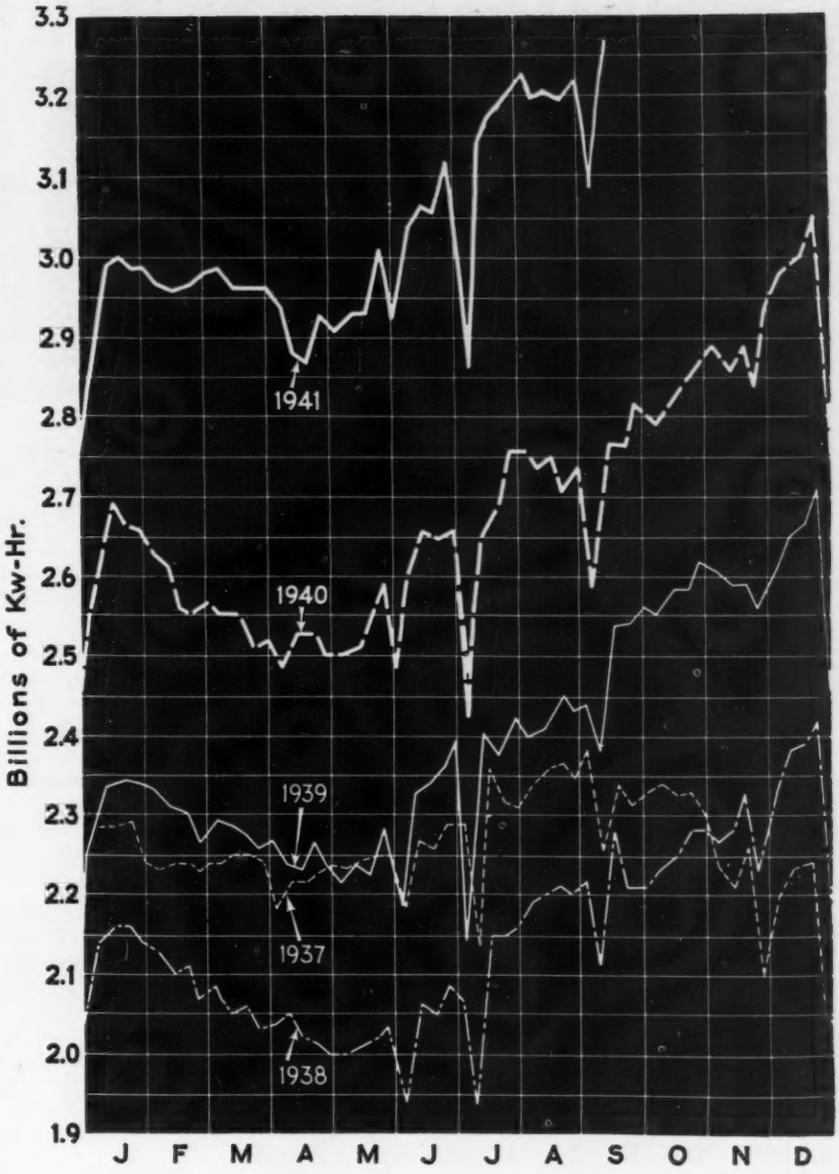
Weekly Output Millions Kw.-Hr.

1941		1940		1939	
Sept. 13	3,281	Sept. 14	2,773	Sept. 16	2,532
Sept. 6	3,096	Sept. 7	2,592	Sept. 9	2,376
Aug. 30	3,224	Aug. 31	2,736	Sept. 2	2,376
Aug. 23	3,193	Aug. 24	2,714	Aug. 26	2,434
Aug. 16	3,201	Aug. 17	2,746	Aug. 19	2,454
Aug. 9	3,196	Aug. 10	2,743	Aug. 12	2,413

Percent Change from Previous Year

	Week Ending		
	Sept. 13	Sept. 6	Aug. 30
New England	+19.6	+21.6	+22.5
Mid-Atlantic	+16.1	+16.1	+16.0
Central Industrial	+19.6	+21.9	+19.3
West Central	+13.8	+17.5	+12.1
Southern States	+27.1	+27.4	+29.8
Rocky Mountain	+ 7.4	+ 7.7	+ 8.5
Pacific Coast	*+10.8	*+10.8	*+10.5
Total United States	+17.7	+19.4	+17.8

* Percentage should be higher — data under revision.



Coal Rate Hits New Low, FPC Reports

The coal rate last year for the production of electric energy was the lowest ever recorded, the Federal Power Commission stated in its report, "Consumption of Fuel for Production of Electric Energy, 1940."

Production of electric energy by use of all types of fuel, except wood, the report states, totaled 96,609,089,000 kw.-hr. during the year, while the consumption of coal and coal equivalent of oil and gas totaled 65,136,000 tons. From these figures the coal rate for the year is found to be 1.35 pounds per kilowatt-hour. This is the lowest coal rate ever recorded and compares with 1.39 pounds per kilowatt-hour for 1939, according to the report.

The report adds that "this low rate was obtained in part at least by the higher efficiency of the new steam plants which were placed in service and higher plant factors, or rates of operation, with a consequent reduction in pounds of coal per kilowatt-hour generated."

Increase in demand for electric power as a result of national defense work, the report pointed out, "has caused a number of plants, which were formerly held as standby or operated only intermittently, to be operated regularly for generating electric energy to serve the increased loads."

During 1940 electric generating plants consumed 53,398,131 tons of coal, 16,771,809 barrels of oil and 183,157,400 MCF of gas. Comparison of these figures with the same statistics for 1939 reveals that coal consumption in 1940 rose 15.5 percent, when oil and gas consumption fell 3.7 percent and 4.2 percent respectively.

Will Rebuild Substation

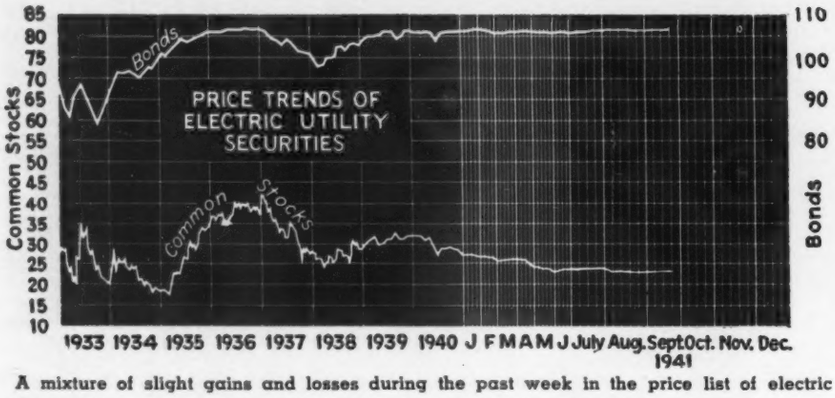
Consumers Power Co. has announced that the Greenville substation would be reconstructed to provide a third outlet to meet increasing demands for power. Work is expected to be completed in November. In addition, a 44,000-volt power line from the Belding-Croton line to the Greenville plant is being constructed.

•

Generator on Trial Run

Grand Coulee dam's first 108,000-kva. generator was recently placed in operation for 30 minutes after undergoing repairs for its second accident in two months. After a series of inspections, the unit will be run on a test basis for eight or ten days before being approved for regular operation.

Light and Power Securities Hold Firm


Common Stocks
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
Bonds
110 100 90 80
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Common Stocks
1933 1934 1935 1936 1937 1938 1939 1940 J F M A M J July Aug. Sept Oct. Nov. Dec. 1941

A mixture of slight gains and losses during the past week in the price list of electric light and power securities left the "Electrical World" stock index unchanged at 23.7 and the bond index unchanged at 105.6

Pacific G. & E. Held Intra-State Company

The Securities and Exchange Commission has declared the Pacific Gas & Electric Co. and its subsidiaries to be predominantly intra-state in character and therefore exempt from regulation as a holding company.

However, S.E.C. further found Pacific Gas & Electric had not proved that it was not subject to a controlling influence of North American and that therefore Pacific Gas & Electric was subject to the regulations of the Holding Company Act governing subsidiary companies of holding companies.

Pacific Gas & Electric had applied for exemption, as an intra-state company, from the Holding Company Act and for an order declaring P. G. & E. not to be a subsidiary of North American.

This week it was held similarly that Public Service Corp. of New Jersey was a subsidiary of United Gas Improvement because U.G.I. and United Corp. controlled 42.3 per cent of Public Service voting securities.

•

United Light Would Form New Utility Company

United Light & Power Co. is considering the formation of a company to be called the Peoples Light & Power Co. to acquire nine Illinois and Iowa properties from United Light. The new company would be owned by the United Light & Railways Co., which would become the top company.

This step was made possible by the recent sale by United Light of 355,250 shares of Northern Natural Gas Co. common shares for about $10,500,000. United Light would be liquidated through the payment of about $16,000,000 of debt and by exchanging United Light & Railways Co. stock, all of which is owned by United Light, for preferred and common stock of United Light.

•

International Paper to Vote on New Set-Up

Shareholders of the International Paper & Power Co. have been called to a special meeting in Boston on September 25 to vote on a plan of corporate simplification under which a new International Paper Co. would replace the present International Paper & Power Co. and its subsidiary, the International Paper Co. This move would signalize the disposal in recent years of practically all the hydro-electric power interests formerly owned by International.

•

Union Electric Issue

Union Electric Co. of Missouri has authorized an increase in its no-par common stock from 2,295,000 shares to 3,300,000. Of the additional stock, 400,000 shares will be sold to North American Co. for $10,000,000, while the remainder will be held as authorized but unissued stock. A total of $9,000,000 of the funds will go toward financing the $19,000,000 Venice, Ill., power plant.

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Plans to Export Energy

Application has been filed with the Federal Power Commission by the California Electric Power Co., Riverside, Calif., formerly the Nevada-California Electric Corp., to continue to export electric energy from the United States to Mexico. California Electric Power Co. is the successor of the Southern Sierras Power Co. and the Yuma Utilities Co., with which it has merged. Both Southern Sierras and Yuma transmitted energy to Mexico before the merger. Annual export of electric energy has not exceeded, and is not estimated to exceed, 13,000,000 kw.-hr.

•

Seeks to Buy Own Stock

Cities Service Co. has filed a petition with the Securities and Exchange Commission, seeking approval of its acquisition of 7,000 shares of Cities Service cumulative preferred stock of no par value, from the British government.

•

Utility Break-Up Values

New York Institute of Finance, formerly the New York Stock Exchange Institute, has announced that it will introduce this fall a new course in "Public Utility Break-Up Values" to consider the effect on public utilities of steps taken by the Securities and Exchange Commission under the Public Utility Holding Company Act.

•

North American Dividend

Directors of The North American Co. have declared a dividend on the common stock payable October 1 in the form of shares of capital stock of the Detroit Edison Co., at the rate of one share of the latter for each fifty shares of North American common stock held, to holders of record September 10.

•

Plans $350,000 Notes

Montana-Dakota Utilities Co., Minneapolis, Minn., has applied to the Federal Power Commission for authority to issue four unsecured purchase money notes in the aggregate principal amount of $350,000 payable in three equal installments on or before April 1, 1943; January 1, 1944, and October 1, 1944. Proceeds are to be used to finance four separate additions to the company's electric and natural gas properties.

Utility Reports

	Net Income 1941	1940
*Birmingham Electric	$725,475	$566,972
*Central Arizona Lt. & Pwr.	668,623	873,145
*El Paso Electric (Tex.)	653,180	457,733
†Electric Pwr. & Lt. and subs.	5,811,994	6,600,888
*Gulf States Utilities	2,277,262	2,746,684
†Louisville Gas & Elec. (Del.)	1,571,451	1,471,494
*Mississippi Power & Light	339,361	466,610
*Puget Sound Pwr. & Lt. and subs.	2,084,681	2,067,571
*Superior Wtr., Lt. & Pwr.	101,836	112,642
*Virginia Elec. & Pwr.	4,313,111	4,076,253
†Wisconsin Electric Pwr.	3,058,511	2,557,916

*Twelve months ended July 31.
†Twelve months ended June 30.

A WHOLE MONTH'S OPERATION AT ONE GLANCE

That's Why You'll Like the One-inch-per-day Chart Speed of This Instrument

THE low chart speed of our new portable recorder gives you a 30-day record (of current or voltage) on a 30-inch chart. This makes it easy to stretch out the entire chart on your desk and see, at one glance, the spread of current or voltage, as well as the duration of maximum and minimum values.

This eliminates the annoyance of having to handle 60 ft of chart (a month's record at the minimum chart speed previously available).

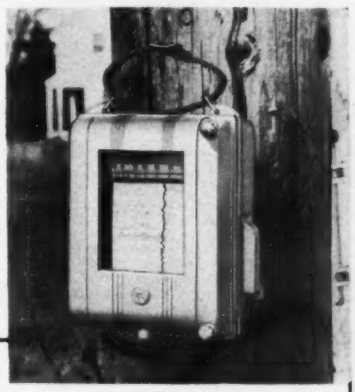
You can obtain this Type CF-1 recorder in both ammeters and voltmeters. Place your order today, and see for yourself how this instrument will simplify the work of analyzing your surveys. General Electric, Schenectady, N. Y.

IT'S INKLESS

1. Requires no attention during a month's operation.

2. No "lost" records, for there's no pen to clog and no ink to freeze or evaporate.

3. Records accurately in temperatures from −10 F to 120 F.



WHERE IT WILL PAY DIVIDENDS

1. For voltage surveys where constant vigilance is necessary in order to detect and correct trouble—thus assuring better service and protecting your revenue.

2. For load surveys of power-station equipment to be sure machines can carry their loads—thus protecting against burnouts.

3. For continuous checks of important transformers—thus guarding against burnouts.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

GENERAL ELECTRIC

602 30-6200

The New and Better Way

THIS

NOT THIS

Properly co-ordinated for better operation, G-E unit substations are easier to buy, easier to install, more attractive in appearance than old-style, piecemeal substations. And these compact, metal-enclosed units can be located almost anywhere—many times in space that is otherwise worthless.

. . to Provide Low-voltage Power

★ IN INDUSTRIAL PLANTS

★ IN COMMERCIAL BUILDINGS

★ FOR POWER-STATION AUXILIARIES

NEW G-E metal-enclosed, ready-to-install UNIT SUBSTATIONS—completely factory assembled and fully co-ordinated for dependable operation—offer these distinct advantages:

Greater Safety

Metal-enclosing of all live parts means greater safety for personnel. Circuit breakers of proper rating assure adequate protection for equipment.

Quick, Easy Installation—Lower Costs

These units are shipped in two or three *complete* sections —all ready to be bolted together and connected to the power cables.

Build no vaults. Make no long secondary runs. Just set these compact, metal-enclosed units near the load center with an obvious saving in time and expense.

Lower System Investment

System investment and losses are considerably lower because Pyranol* permits installation right at load centers, thereby eliminating long, costly, low-voltage circuits from a distant substation. Performance of motors, lamps, etc. is improved because the voltage-drop in such long, low-voltage circuits is avoided.

Simplified Purchasing

Only *one* purchase transaction, involving a simple, functional specification, is required; the entire equipment comes from one manufacturer. The purchaser is thus relieved of all design and co-ordination problems.

THESE standard *unit substations* are now available for serving loads 600 volts and below (120/208Y, 480 volts, etc.) from incoming lines up to 15 kv. They can be furnished for outdoor as well as indoor installation.

A metal-clad incoming-line section with oil-blast or magne-blast power circuit breakers, a Pyranol* (or oil-filled) transformer section, and a low-voltage feeder section with air circuit breakers comprise these units—smaller editions of the higher-voltage G-E unit substations that have proved themselves in more than 200 central station installations during the last ten years.

Here's the modern way to help assure an adequate, reliable power supply at all times—more important than ever in the light of present conditions. Bulletin GEA-3592 gives further details on these money-saving units. Ask your G-E representative for a copy. General Electric, Schenectady, N. Y.

*PYRANOL is G.E.'s trade-mark for a nonsludging, insulating and cooling liquid that will not burn.

GENERAL ELECTRIC

401-8-170C

OPERATING PRACTICES

Radio-Equipped Plane Spots Line Trouble

As a means of reducing service interruptions during emergency periods on its more inaccessible transmission lines, the Northwestern Electric Co., Portland, Ore., has made a successful experiment with aerial line patrol, using two-way radio equipment. A. A. Mangold, system betterment engineer, made the announcement after a trial flight by airplane from Portland to Northern substation, above Kalama, Wash. This experiment also included communication over Northwestern's short-wave system in connection with the national defense program.

From Ariel Dam in Washington to Northern substation the country is very mountainous and the line is subject to breaks during winter storms. There is no patrol road to accommodate motorized equipment. Patroling on foot is slow and arduous, requiring six to eight hours with a crew of seven men. If there is a break, no one knows where it is located or what its nature is, whether from falling tree, slide or other cause, and what equipment will be required to repair it. The only way now is to take everything and start from one end, or with two crews from both ends.

By means of the aerial patrol the nature and location of the trouble can be ascertained quickly. There are certain points at which access may be had to the patrol. The necessary men and equipment can be rushed to the nearest point of access in much less time.

On this experimental flight with chartered plane equipped with the company's short-wave tranceivers, its two-way radio car picked up messages from the plane. These messages were relayed to Portland through the short-wave radio system of the Portland General Electric Company. At Ariel the regular ground station was also used.

Along the line fake obstructions had been placed. These were readily seen from the plane, as were the lines and insulators; the plane flying at an elevation of 500 to 1,000 ft. Indications were that the station at Ariel was sufficient, though the two-way radio car was also entirely feasible.

Only one hour and five minutes was required for the flight from Swan Island airport in Portland out over the section of line and return, a distance of approximately 110 miles. Such are the facilities of the airport that take-off with a hired plane is possible at any time within half an hour after the trouble call originates. Thus, men can be rushed direct to the break by the shortest route almost as soon as the trouble is spotted. Chartered planes are indicated as much more economical than maintaining a special plane and crew.

ALL SET for the experimental flight to spot line trouble—(left to right) Pilot Morgan Schrack of S&M Flying Service; Corbett McLean of Northwestern Electric Co. engineering department, observer; Ray Spaulding of the meter department, radio technician

•

Capacitors Postpone Regulator Outlay

To improve power factor and line voltage regulation the Holden, Mass., municipal lighting department recently installed 120 kva. in G.E. pole type capacitors at strategic points on its 2,300-volt distribution system and thereby enabled the purchase of additional regulator capacity to be postponed in the face of increasing loads. An alternative plan was to reconnect the regulators for 5 percent buck and boost in place of the former 10 percent range. While this would have increased the ampere capacity at

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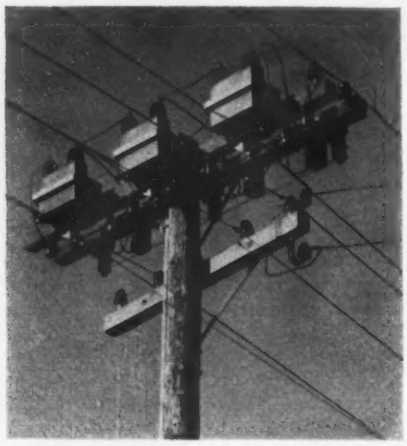
GENERAL ELECTRIC

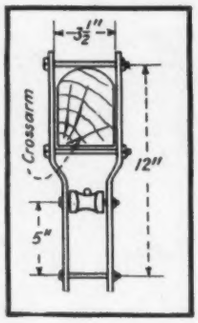
2,300 volts, it would not have given the desired voltage on the distribution circuits. Acquisition of the capacitors unloaded the substation regulators sufficiently to enable the 10 percent voltage range to be maintained, and the voltage level at the ends of the feeders was increased about 5 percent. The power factor at the substation, formerly 70 to 80 percent on the system (largely residential customers), was raised to approximately 90 to 95 percent, and allowing for the



DISTRIBUTED UNITS improve voltage conditions on feeders

economies resulting from reduced system copper losses, metering consumptions at higher voltages and a postponement of the purchase of additional regulator capacity, the capacitor installation is self-liquidating in about two years. In typical installations the capacitor set-up consisted of 15-kva. units mounted at the pole top across the phases, each capacitor being connected to a delta phase and provided with a fused cutout and lightning arrester wired to a common ground connection.

Fixture Carries Neutral Under Crossarm



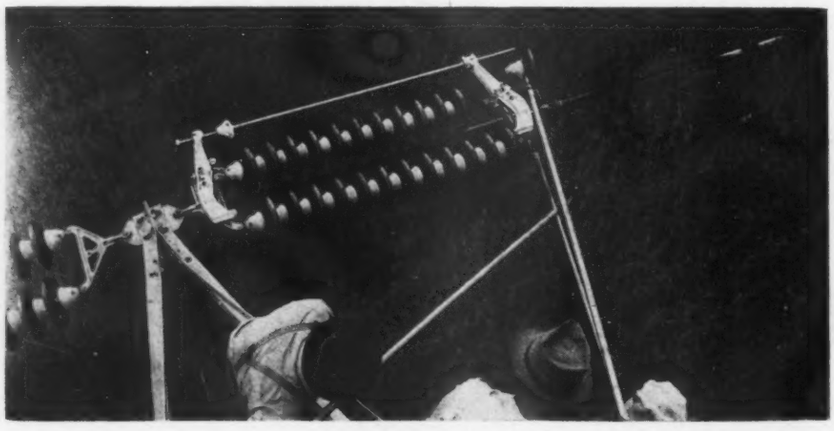
For carrying the neutral of secondary circuits from one end of a crossarm to another in instances where several services are taken from the same transformer pole, Public Service Company of Colorado engineers have developed the inexpensive fixture shown in the accompanying sketch. The device, which bolts around the crossarm and projects below it, is provided with a conventional spool type insulator to which the neutral is attached. Provision is made on the fixture for the addition of a second spool insulator which can be used to carry a "hot leg" of the secondary circuit if more extensive bussing is desired.

•

Dead-end Tool for String-unit Change

J. W. CONRAD
Transmission Foreman,
Ohio Power Company, Canton

An improved dead-end tool has been devised for making live line replacement of insulator units at dead-end assemblies. It consists of two-yoke grips and a wood pole which releases the tension on one string of a double-string strain so that a disk can be changed. It is adaptable to any voltage level by proper choice of the length of the pole.



DEAD-END UNIT replaced by means of live-line strain rig.

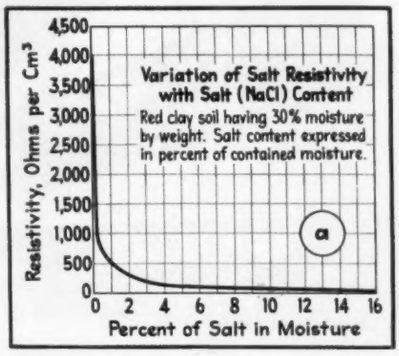
The pole is a part of a standard utility live-line tool. It is clamped tight at the conductor end by means of an adjustable clamp and swivels at the tower-end on a roller-bearing screw operated by a ratchet handle.

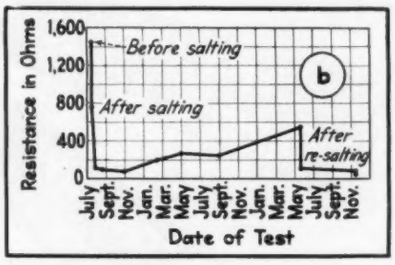
•

Effect of Salt on Soil Resistivity

By J. R. EATON*
Purdue University, Lafayette, Ind

In some locations the resistivity of the earth is so high that low-resistance grounding connections are obtainable only at the considerable





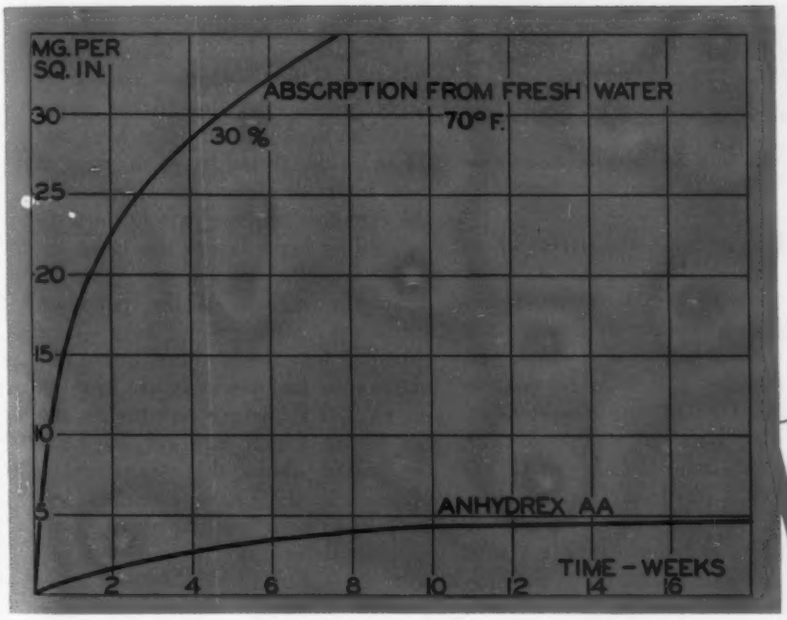
SOIL RESISTIVITY decreases as salt content increases (a). This chart relates to red clay soil having 30 percent moisture by weight, salt content being expressed in percent of contained moisture. Resistance of a ground rod also varies with the time following salt treatment of the soil

expense necessary for the installation of an elaborate electrode system. In such situations it is often economical to use an electrode system of limited size and to reduce the ground resistivity by increasing the soluble chemical content of the soil through the application of salt (sodium chloride) in the vicinity of the electrodes.

The accompanying table and chart show the great reduction in the resistivity of sandy loam and red clay

* Consultant for James G. Biddle Co.

KEEP WATER OUT of INSULATED CABLES



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Simplex Wire & Cable Company, 79 Sidney Street, Cambridge, Mass.

SIMPLEX WIRES CABLES

Effect of Salt Content on Soil Resistivity

(Sandy loam; moisture content 15 percent by weight; temperature 17 deg. C.)

Added Salt (Percent by Weight of Moisture.)	Resistivity (Ohms/cm.³)
0	10,700
0.1	1,800
1.0	460
5	190
10	130
20	100

Effect of Temperature on Resistivity of Soil Containing Salt

(Sandy loam; 20 percent moisture; salt 5 percent by weight of moisture)

Temperature (Deg. C.)	Resistivity (Ohms/cm.³)
20	110
10	142
0	190
—5	312
—15	1,440

which may be brought about through an increase in the salt content of the soil. It may be noted that the addition of salt equivalent to 20 percent of the weight of the moisture content resulted in a reduction in the resistivity of sandy loam by a factor of one hundred to one.

Soil which has been salted is also subject to considerable variation of resistivity with variations in temperature. A second accompanying table shows a variation in resistivity from 110 ohms per centimeter cube at 20 deg. to 1,440 ohms per centimeter cube at —15 deg. C. The rise in resistivity at temperatures below the freezing point is not nearly so great as that observed in the untreated soil (ELECTRICAL WORLD, August 23).

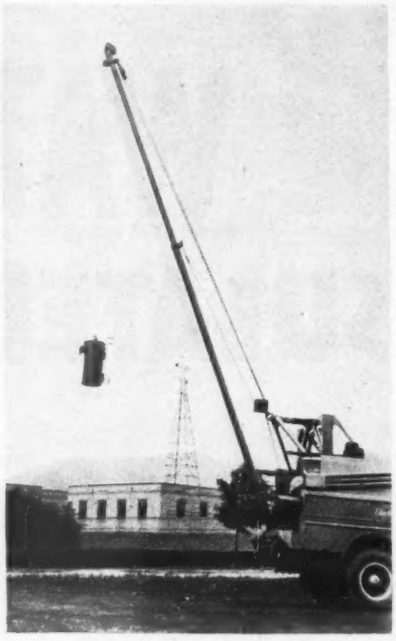
Since salt is readily soluble in water, obviously the salt content of a soil will change as the salt is carried away by the leaching process. An accompanying chart showing the change with time of the resistance of an experimental ground connection indicates that the resistance dropped suddenly soon after the application of the salt treatment, and then gradually rose to about 25 percent of its original value at the end of about eighteen months. At that time the soil was given a second treatment and the resistance again dropped to a low value. If the salt treatment is employed, it is of course necessary to use ground electrodes of a material which is unaffected by salt in the presence of soil.

[ED. NOTE—This is the fifth in a series of articles discussing various phases of grounding.]

Swing Boom Sets Poles, Transformers

By B. C. STOLZE

Superintendent of Distribution
Wheeling Electric Company, Wheeling, W. Va.



BOOM can pick up pole or transformer without having to back up to location

In alleys or congested streets where it is impossible to use a truck equipped with an A frame it has proved advantageous to provide the truck with a boom rig which can swing through 170 deg., 85 deg. to each side. One of our newest GMC trucks has been so equipped. The chassis has a straight rating of 17,000 lb. (7,000 lb. pay load) and the body was made by American Coach & Body Company. The boom can lift 3 tons at the rear and 2 tons off at the side with an 18-ft. reach from the vertical. When assembled it has a 36-ft. length and was made by Silent Hoist Winch & Crane Company.

It is estimated that on certain particular jobs this device saves a minimum of six man-hours per day. On account of the many narrow thoroughfares in this community it would be impossible to use a standard A frame in most cases. This device has therefore proved to be invaluable to us. It is also a decided safety factor.

•

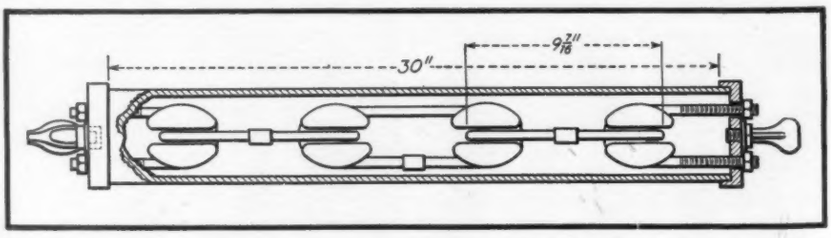
Guy Strain Insulator Assembly Interlocks

A guy strain insulator suitable for 13- and 33-kv. lines has been fabricated by Philadelphia Electric Company from a chain of interlocking insulators and steel links all inclosed in a 4-in. (inside diameter) Orangeburg fiber tube filled with Minerallac No. 78 or equivalent insulating compound. Joslyn Thimbleye nuts provide the guy strand connections. Galvanized end plates and Everdur nuts on the protruding V-bolts give weather resistance. The interlocking links are of 7/15-in. cold-rolled steel of 55,000 lb. quality.

Pressure cushions between the links and the insulators consist of three layers of yellow Armo paper (0.02 in. thick) about $5\frac{1}{8}$ in. long and $1\frac{1}{4}$ in. wide, slitted to $\frac{5}{16}$ in. deep at $\frac{1}{4}$-in. intervals along each side so that the cushions can conform to the $2\frac{1}{16}$-in. radius bend inside the links.

All metallic marks are removed from the surface of the porcelain insulators after they have been threaded into the chain of links. The entire tube and assembly are brought up to 280 F. before pouring in the compound, which, however, must not be heated above that temperature. Meanwhile the chain assembly has previously been brought up to a tension of about 8,000 lb. and relaxed to 2,500-3,500 lb.

This patented interlocking guy strain insulator is particularly applicable where insulation is needed on the guy between the transmission arm and the distribution wires because it has no arcing horns to foul the wires. It also has the advantage of mechanical continuity and of not being affected by fire close to the line.



FIBER TUBE, navy type insulators and compound assembled into guy strain for 13- and 33-kv. lines

INDUSTRIAL ENGINEERING

Condenser Discharge Welders for Aircraft

By C. W. DODGE
Vought-Sikorsky Aircraft, Stratford, Conn.

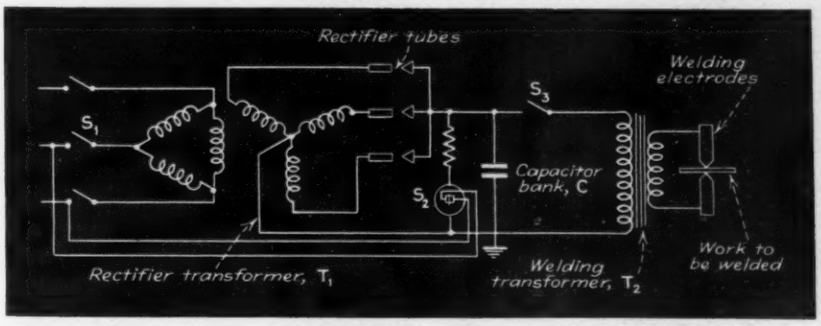
Utilization of "condenser discharge" welders for spot-welding aluminum alloys has effected reduction in demand, improvement in power factor and voltage regulation and changed a single-phase to a three-phase load at the Vought-Sikorsky Aircraft Division, United Aircraft Corporation.

These machines store energy for the weld by charging a capacitor bank to a predetermined voltage and then discharging it into the primary of the welding transformer by closing a contactor as the weld is to be made (see caption).

Each new machine is capable of doing the same work as any of the three single-phase a.c. machines replaced, two 300 kva. and one 350 kva., which were supplied by a 440-volt bus from a 6,900-volt step-down transformer. In operation these machines showed a power factor as low as 0.3. A voltage drop of 100 volts in the 100-ft. cable run from the bus to the machines was also experienced at maximum demand, approximately 1,500 amp. on each machine.

Series capacitors would have raised the power factor of the old machines, but would still have left a single-phase intermittent load. By the use of condenser discharge machines three 40-kva. units proved adequate. These operate directly from the plant's 220-volt distribution system and draw about 100 amp. maximum. Power factor is now in the neighborhood of unity. An operating speed of 75 spots per minute is obtainable on stock of 0.040 in. thickness.

The new equipment is more compact that its predecessors, control devices and capacitors being located in a single cabinet placed alongside the welder. An added degree of flexibility is secured since the machines operate off the plant supply. No serious operating difficulties have been encountered in the year the machines have been in use. The original cost of the equipment was about half again as much as that for equivalent a.c. machines, or approximately the same, considering the cost of supply transformer and installation of the latter.

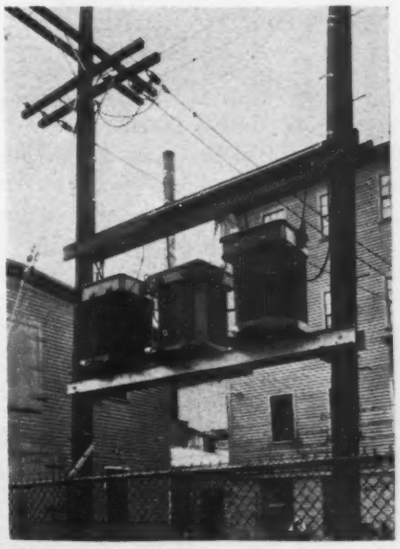


STORED ENERGY welding machine (schematic diagram)

Closing switch S1 energizes rectifier transformer T1, which charges capacitor C. Voltage on C rises to value sufficient to operate coil of normally closed relay S2, which opens switch S1, stopping charging current. To make weld, contactor S3 is closed, discharging capacitor C through primary of welding transformer, causing secondary current to flow in T2 and making the weld. Total amount of energy for making weld and overcoming machine losses is also amount of energy stored in capacitor, which may be controlled by adjusting voltage to which it is charged.

•

Fiber Conduit for Simpler Pole Work



In serving an industrial plant adjacent to a defense district the transformer layout was greatly simplified by utilizing fiber conduit to carry the primary and secondary conductors to and from three 75-kva. units forming the factory bank as illustrated. It was important to conserve material as much as possible, besides insuring maximum clearance on and around the poles, protecting the wiring from outside interference and also providing liberal climbing space for linemen and maintenance men. This was

done by mounting the transformers on six 1¼x4-in. wooden planks carried on two 6-in. channel-irons bolted into the poles on each side and in turn supported by 4-in. channels forming brackets on the insides of the poles; the 4-kv., three-phase, four-wire grounded neutral primary leads were then cabled down one pole and carried horizontally along inside a 3-in. fiber conduit (half-round, strapped to a 1¼x6-in. wooden cross-brace) to taps leading to the primary terminals, one cable going to ground. The 575-volt secondaries, run in cabled delta, were similarly disposed of in fiber conduit, supported in half-round section by clamps attached to a cross brace on the opposite side of the pole structure, and then run up a pole in cabling and thence to the factory.

The additional protection afforded by the conduit is secured at relatively small cost, as only short runs are required and numerous fittings and extra arm construction are eliminated.

•

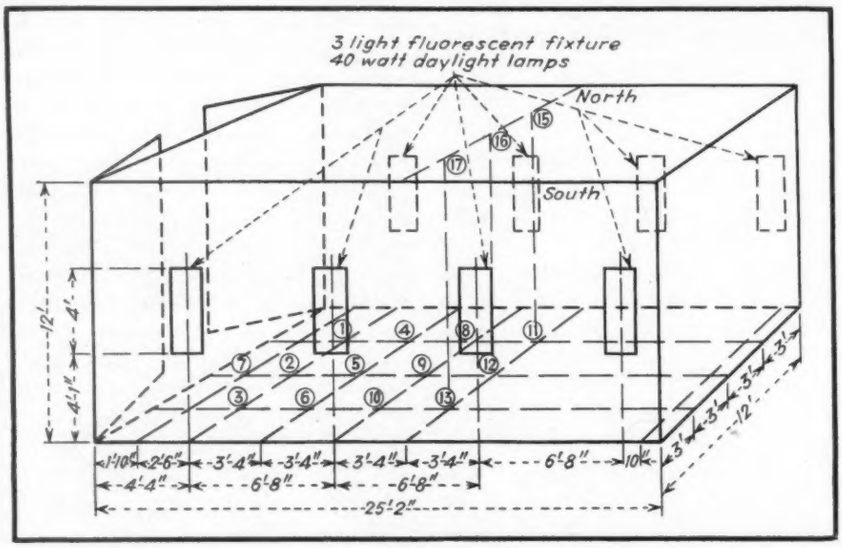
A Fluorescent-Lighted Paint Spray Booth

Lighting design for a spray painting booth at an Indianapolis service station of International Harvester Company is shown in accompanying illustrations. Notable because of the to-date limited application of fluorescent lighting to industrial spray booths, this installation reveals an effective approach to lighting of such installations with fluorescent sources.

The booth in question is of sheet metal 25 ft. long, 12 ft. wide and 12 ft. high, with aluminum painted walls and ceiling and a concrete floor. It was desirable to use light sources large enough to illuminate the top as well as sides of automotive trucks and truck bodies. Eight three-lamp fluorescent reflectors equipped with 40-watt T-12 daylight lamps were selected and mounted outside the booth with their axes oriented vertically, as shown. Light from the units enters the booth through four clear wire-glass window panels 52 in. high and 15 in. wide, spaced on 6-ft. 8-in. centers along each side of the booth. Bottom of the window panels is 4 ft. from the booth floor.

Horizontal foot-candle intensity at the floor of the booth ranges from a maximum of 27 to a minimum of 13.5 ft.-candles. In the approximate center of the booth ceiling illumination is 20 ft.-candles. Data on light distribution within the booth is given in the table below the illustration.

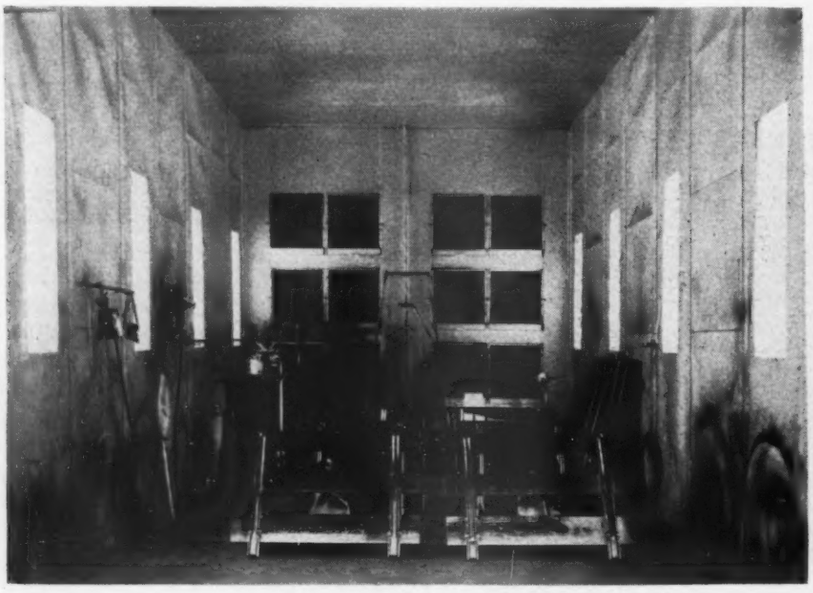
Lighting design for this booth was worked out by lighting specialists of the Indianapolis Power & Light Company in cooperation with the International Harvester Company.



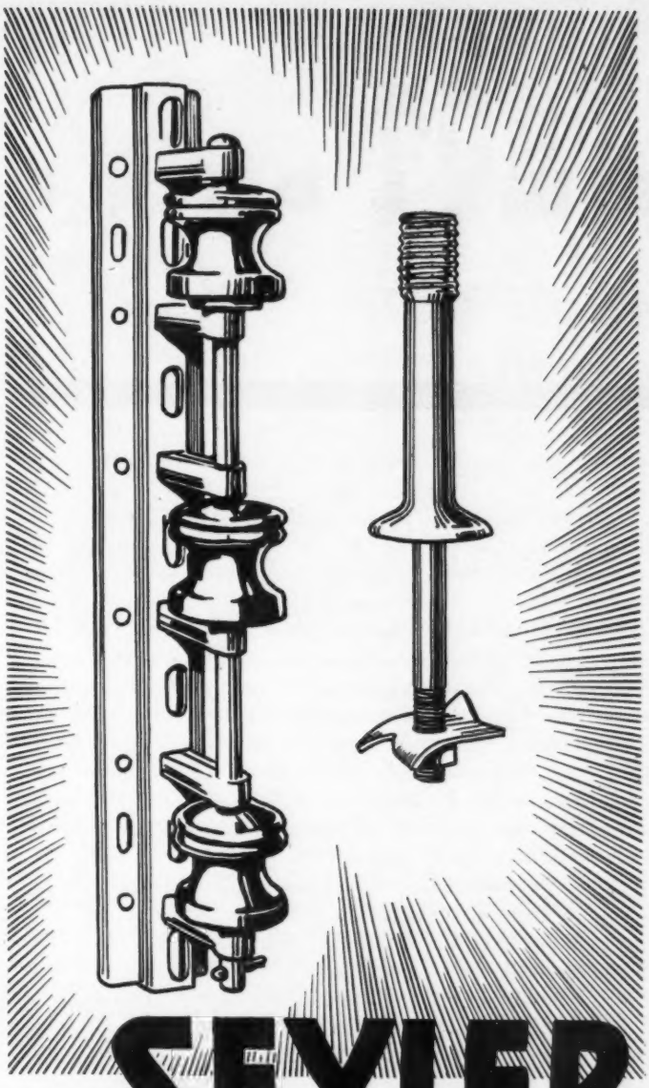
LOCATIONS of fixtures and light intensities at points on floor and ceiling

Points	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15*	16*	17*
Hor. F. C.	17	20	18	19	26.5	20	13.5	20	24	22	20	27	21.5	15	20	20	20

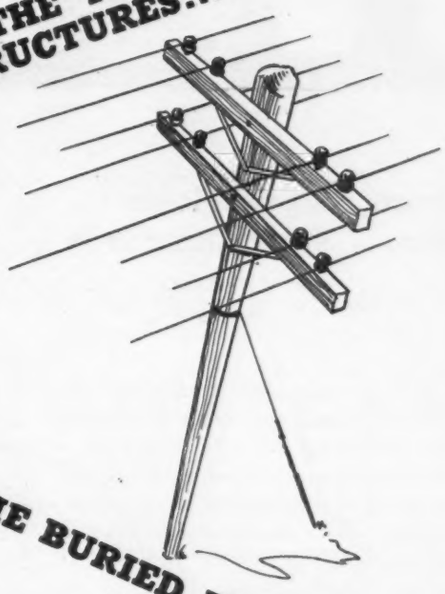
*Ceiling.



BOOTH for spray painting of truck bodies fluorescent lighted to 20 ft.-candles (left). Three lamp fixtures with 40-watt daylight tubes are mounted outside the booth back of wire-glass windows (right)



FROM THE TOPS OF STRUCTURES...



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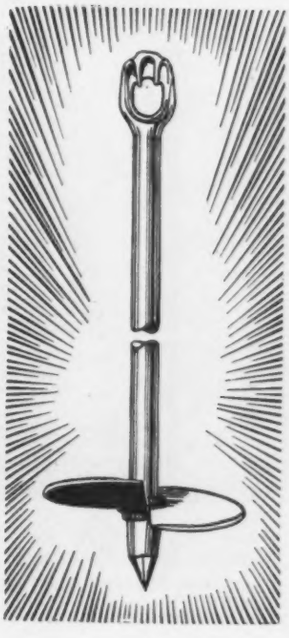

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LOAD BUILDING

Infra Red on Molds Meets Navy Standards

By L. M. DURYEE
Industrial Power Engineer
Connecticut Light & Power Co., Waterbury

A few weeks ago the head of the Krodel Brass Foundry in Waterbury was departing from the office of a well-known manufacturer in that city engaged in 100 percent Navy work. Noting the somewhat lengthened Krodel countenance, the author went over and said: "Don't tell me; let me guess. Your castings aren't what the Navy wants—specifications are tough, and your casting surfaces are imperfect when machined. How do you dress your molds?"

"We skin dry with charcoal—what do you know about castings?"

"Nothing much, except that the skin drying has to be uniform; heat must penetrate, and no edges of sand can stand being cooked."

We introduced the subject of electric infra-red and made a date for the next day. We took our sample radiant heat lamp frames into the foundry and dried the first green sand mold in two hours to a depth of 2 in., absolutely uniformly. Infra-red has to do it uniformly, because the lamps are uniform in heat output, the rays are parallel and the sockets are spaced just 6 in. apart all around. The frame we used, just a home-made demonstrating model, was wood with porcelain sockets, each frame containing a bank of twelve R-40 reflector type drying lamps, 250 watts each, 120-volt rating.

As a result of the demonstration we simply couldn't get our frames back. Mr. Krodel used them continuously until he could have his own metal frames built, with wiring inclosed in conduit. Most important of all, the manufacturer whom he supplies with his present high-grade castings can now machine them with perfect surfaces, minus blowholes. The foundry now has eight infra-red frames ranging from 20 x 24 in. to 24 x 33 in. to fit all sizes of green-sand molds it makes.

The total connected load is 64 kw., of which 32 kw. is in use continuously eight hours per day. The equipment cost $300.

Labor saving is considerable. Formerly a man was more or less continuously employed in putting burning charcoal on a tray, arranging it over the mold and then blowing out the charcoal from the mold with compressed air. When drying was over, castings were unsatisfactory because trays filled with burning charcoal gave out non-uniform heat. Charcoal cost $300 a month. With infra-red drying, labor is reduced to a minimum. A man puts the infra-red bank over the mold, plugs it into the socket and goes about other work. Two hours later he removes the frame. The mold is uniformly skin-dried and nothing has fallen into it which must be blown out.

Lamps in the frames are wired in series, so that 120-volt lamps are operated in pairs across 240-volt, three-phase power service, and no insulating lighting transformers are required to provide proper voltage at lamp terminals. A new 400-amp., three-phase power service has been installed, with four 60-amp. plug receptacles to serve each of the four frames in continuous daily use. In

CHARCOAL was used under old method of drying molds for castings, resulting in uneven heat, unsatisfactory surfaces, extra cleaning operations

UNDER new infra-red method, a set of eight infra-red frames is employed to get clean molds, uniform heating resulting in easily machined satisfactory castings

FORTY-NINERS

SCORE 500 VICTORIES FOR BETTER LIGHT-BETTER SIGHT IN 5 MONTHS!

Inspire 50-footcandle installations in stores, offices, and factories where higher lighting levels speed sales, improve work and boost production.

THAT HIGHER LEVELS OF LIGHTING are being sold and bought is evidenced by the 500 50-footcandle installations reported by the Forty-Nine Footcandle Club between March 1, and August 1, 1941. Indicative of the gains that fluorescent lighting is making is the fact that more than 78% of these installations are MAZDA F! Of the 500 installations, 51% are office, 32% are commercial, and 17% are industrial. They cover 2,843,795 square feet—more than 65 acres—and average approximately 3 watts per square foot.

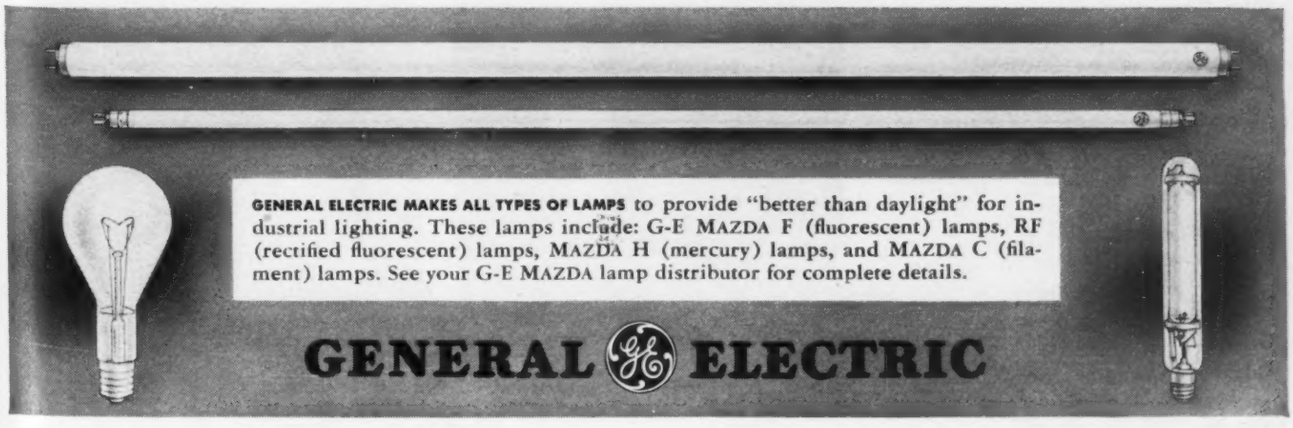
ALL OF THESE INSTALLATIONS represent constructive selling and intelligent buying to provide higher levels of lighting so urgently needed for more efficient working conditions in offices, better selling conditions in stores, and for faster production in industry, especially defense industries. Primarily they demonstrate that more customers have recognized the need for properly engineered lighting . . . the amount of light that helps them work more efficiently.

NATURALLY THERE ARE other 50-footcandle installations scattered throughout the country not inspired by the Forty-Niners' Club, but the fact is that those participating in the 49-Footcandle Club are doing a swell job. If you don't have your share of 50-footcandle installations on your lines, General Electric will be glad to help you organize your own 49-Footcandle Club.

Membership is open to salesmen primarily responsible for selling installations of 49-footcandles or more, or to executives working under 49 or more maintained footcandles. The attractive emblem shown here will be sent to all members. A brief description of the installation, attested by the sales manager, is all that is necessary for membership. Send it to: Secretary, Forty-Niners' Club, General Electric Company, Nela Park, Cleveland, Ohio or consult your G-E Lamp Division.

HIGHLIGHTS OF THE 500 50-FOOTCANDLE INSTALLATIONS

Total Square Feet covered		2,843,795
Total Watts installed		8,529,745
Total number of lamps used		125,928
Total number of fixtures		66,210
Average square feet per lamp for all sources		22.5
DISTRIBUTION OF LIGHT SOURCES:	MAZDA F	78.4%
	MAZDA C (incandescent)	10.4%
	Combination fluorescent and incandescent	6.8%
	RF—85 watt	2.0%
	Combination mercury and incandescent	1.4%
	MAZDA H (mercury)	1.0%
		100.0%


GENERAL ELECTRIC MAKES ALL TYPES OF LAMPS to provide "better than daylight" for industrial lighting. These lamps include: G-E MAZDA F (fluorescent) lamps, RF (rectified fluorescent) lamps, MAZDA H (mercury) lamps, and MAZDA C (filament) lamps. See your G-E MAZDA lamp distributor for complete details.
GENERAL ELECTRIC

this foundry the direct fuel saving is $300 for charcoal less $150 per month electric bill, or $150 per month net economy. Important Navy work is being speeded by this example of co-operation between the utility and the industrial customer.

•

South Bend Show Sets Sales Records

A total of 246 appliances having a retail value of $34,558.05 is the record hung up by 25 electric appliance dealers of South Bend, Ind., for business sold from the floor during their annual six-day Electrical Show conducted in cooperation with the local electrical league and the Indiana-Michigan Electric Company. Results of the March, 1941, show exceed those of the two previous shows in both unit sales and dollar volue. In 1940 215 units valued at $30,457.85 were sold from the floor and in 1939 it was 121 units at $17,385.95.

Breakdown of the appliances sold on the floor at the recent show is as follows:

35	Ranges	$5,451.90
101	Refrigerators	17,657.20
8	Radios	839.25
6	Water heaters	399.45
15	Washers	1,245.75
33	Small miscellaneous items	332.20
20	Stokers and oil burners	6,839.60
20	Sweepers	689.90
3	Water softeners	620.00
1	Pump	83.00
4	Ironers	399.80
246		$34,558.05

Several practices are followed at the annual South Bend appliance shows which contribute to make them *selling* shows instead of electrical expositions.

Shows are allowed to run a sufficient number of days and nights, usually six, to spread the attendance out, thus giving interested buyers an opportunity to visit the show two or three times. Crowds and jams are not desired. Thinner attendance gives each dealer plenty of time to bring sales pressure to bear on prospects. From a selling angle it is felt that too many people are as bad as none at all. Attendance at this year's show was 25,000.

No entertainment is provided other than educational features secured from within the industry. Nothing is done to attract the strictly pleasure bound. This year, however, several semi-scientific demonstrations were used to attract the more serious minded and supply the newspapers with promotional publicity material.

Third cardinal rule of South Bend appliance shows is that nothing shall be given away; no appliance can be offered as an attendance prize or in a raffle, lottery, etc. While there is no objection to passing out advertising novelties such as balloons, yardsticks, etc., even these are conspicuous by their absence. No "deals" are permitted other than those authorized by the distributor.

Inducements to salesmen are offered by the show committee and by some individual dealers for their own salesmen making immediate sales from the floor in volume. These shows are notable as a dealers' activity, since they draw the dealers together for other cooperative promotions and prove to them the value of united effort.

Result of all this is that each dealer looks forward to selling and prepares himself for it by not only arranging his display with sales in mind but by making provisions for ample newspaper advertising and arranging contests for his salesmen, knowing that the results he secures depend entirely upon the efforts he makes.

BLUE fluorescent light from interior lamps makes windows stand out against gold background

•

Colored Fluorescent Floods Dairy Building

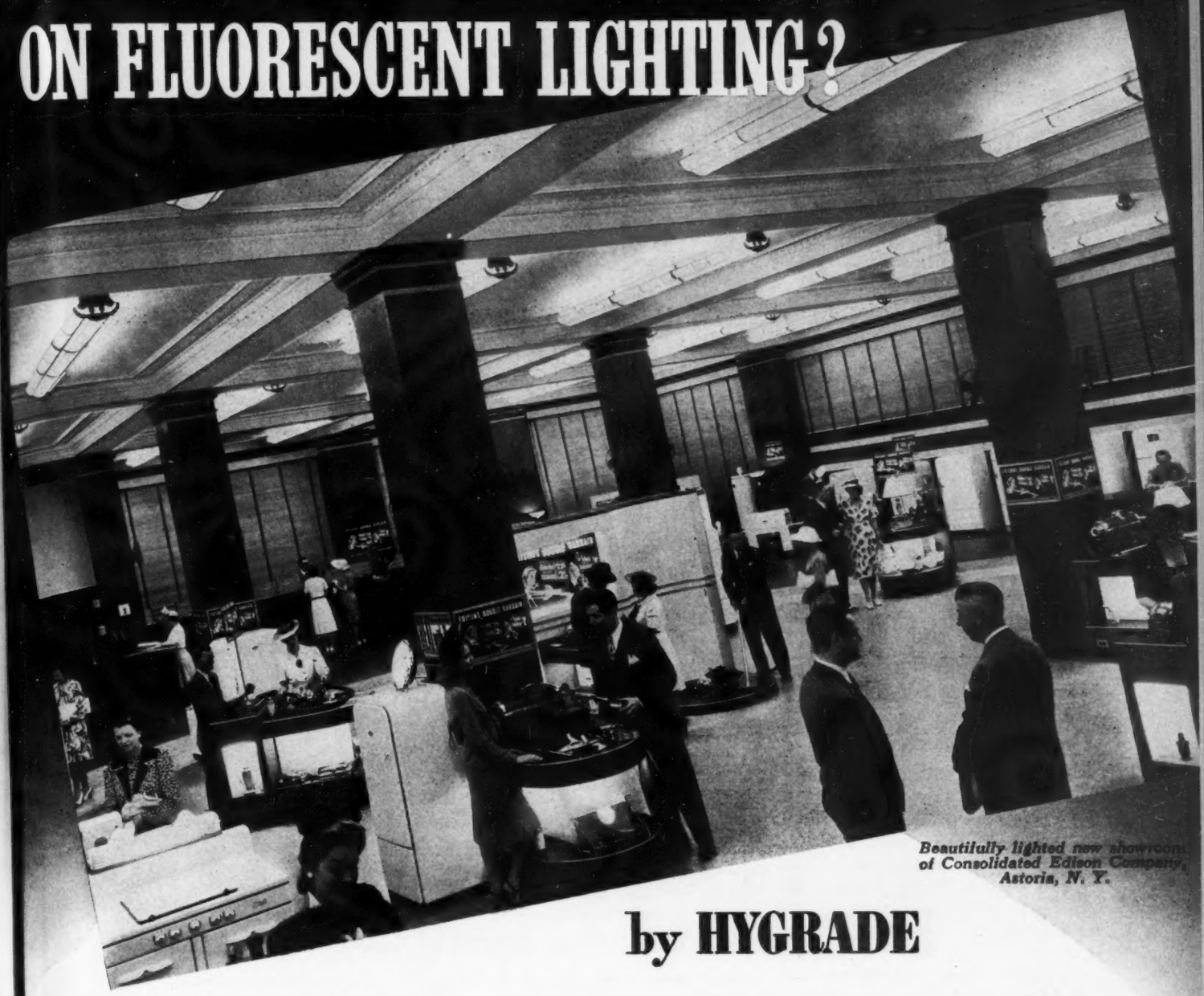
Pink and gold fluorescent lamps in weatherproof trough reflectors have been used effectively to floodlight the Hawthorn Mellody Farms Dairy building on the Skokie highway near Highland Park, Illinois, a few miles northwest of Chicago.

Upwards of 25 glass-inclosed trough reflectors, concealed behind evergreen shrubs, are used to light the exterior of the whitewashed brick building. Each trough is 36 in. long, 15 in. wide and 8 in. deep and contains two parallel 30-watt, 36-in. lamps. Gold light is directed at the wall area between windows to contrast with the evergreen. The tower is lighted in pink.

Blue fluorescent light from two 30-watt, 36-in. tubes in open troughs inside each window bathe the white venetian blinds and contrast pleasantly with exterior illumination.

COLORED fluorescent lamps in weatherproof trough fixtures floodlight exterior of Illinois dairy building. Areas between windows lighted by gold lamps; the tower is pink

WHAT'S THE REAL LOW DOWN ON FLUORESCENT LIGHTING?



Beautifully lighted new showroom of Consolidated Edison Company, Astoria, N. Y.

by HYGRADE

LET'S admit it—Fluorescent lighting can be a terrific headache — both to Utility and Client. But it can also be a monumental aid to better plant production—better store sales—better office efficiency. Depends entirely on how you plan it.

Three things to look into are:

(1) *The extent of the manufacturer's experience.* A good lamp or fixture is not *in itself* a guarantee of a good lighting job. A company that visualizes a *complete* job is obviously a safer bet than one that sees only a part of it. In this respect, it's significant to note that HYGRADE makes *everything* for fluorescent lighting!

(2) *The manufacturer's standards.* HYGRADE employs only the *best* — in brains, materials, and workmanship. That's why HYGRADE can offer a *complete* guarantee covering the entire lighting job—lamps, fixtures, starters, *everything!*

(3) *The manufacturer's policies.* Both specifying and installing fluorescent is many times easier, faster and more efficient if the manufacturer assembles and ships units complete. HYGRADE does this.

There you have just three of *many* reasons why we sincerely believe you'll do a better job—both for yourself and your clients—by specifying HYGRADE —always! For the *complete* story—

Write today for free, file-sized kit — containing catalogue, prices and complete technical specifications on all Hygrade Fluorescent Lighting equipment.

HYGRADE SYLVANIA CORPORATION
Salem, Mass. Est. 1901

Also makers of Hygrade Incandescent Lamps and Sylvania Radio Tubes.

HYGRADE—

Everything in Fluorescent at its Finest!

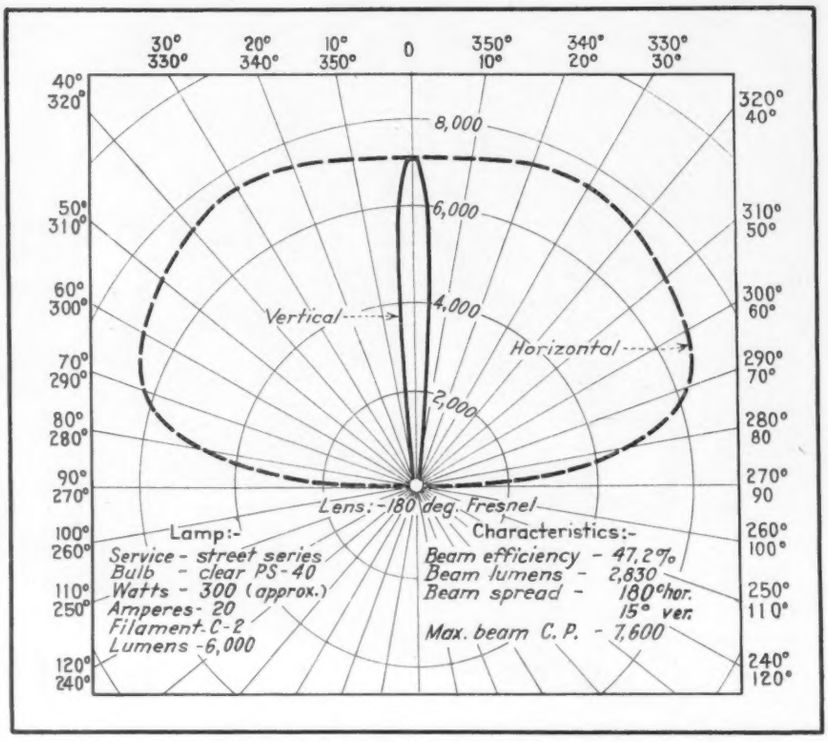
NEW ENGINEERING IDEAS

Anti-Sabotage Flood Reduces Fence Glare

Out of development work at the Kingsbury Ordnance Plant in Indiana has come a radically new anti-sabotage floodlight design that is first cousin—in appearance at least—to a sea-going binnacle lamp, and that offers a new approach to some of the problems of protective lighting.

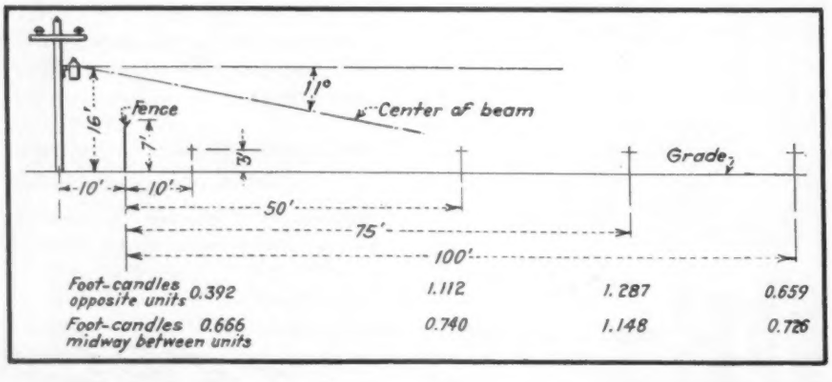
The luminaire used at Kingsbury, and since applied to several other defense projects, employs a 6,000-lumen series-type street light lamp behind a 180-deg. fresnel type lens in a cast-iron housing with an aluminum reflector. When mounted 10 ft. back of the fence line and 16 to 20 ft. high it projects a thin fan-shaped wedge of light 180 deg. wide and 15 deg. in vertical thickness across the fence top and into the approach area outside, illuminating it for an effective distance of about 200 yd. Top cutoff of the beam is about at mounting height; bottom cutoff is approximately at the top of the fence.

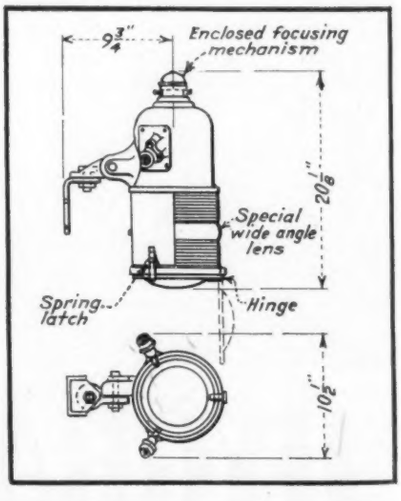
This type of lighting illuminates



NEW anti-sabotage floodlight with fresnel lens throws thin fan-shaped beam

ILLUMINATION in fence-approach area reveals intruders at 200 yards (below). Wide angle floodlight design uses 2,500- to 10,000-lumen series street lamps; Mounts on wall or pole (at right)





40 Years of Service . . . to the Electrical Industry

Younger than some of our customers, older than others, AMERTRAN takes pride in the service it has rendered and will continue to render, in supplying quality transformers and other static inductive machinery to utility companies, manufacturers and contractors in the electrical field. In design, engineering and manufacture, we have kept pace with progress. A list of customers for AMERTRAN equipment constitutes a blue ribbon group of American industry. It is also our privilege to serve a number of important projects connected with the United States Government and with industrial activities in defense work. We proudly accept this responsibility; and to this work, as to all industry, we pledge our fullest cooperation.

AMERICAN TRANSFORMER CO.

178 Emmet St. Newark, N. J.

AMERTRAN

the area beyond the fence clearly, while effectively blacking out the patrol area inside the fence to anyone facing the lights. Perhaps more important, however, is the fact that spill light on the fence itself is limited to an amount just sufficient to make it visible, yet not enough to allow reflected light from the fence to screen the approach area when viewed from the guard station.

At the Kingsbury installation units were mounted 125 ft. apart along the fence and produced illumination in the approach area opposite units estimated to range from 1.12 ft.-candles at 50 ft. to 0.69 ft.-candle at 100 ft. on a vertical surface 3 ft. above grade. The fixture was developed by the Revere Electric Manufacturing Company, Chicago.

•

Pole Class Calculator

V. W. PALEN
Eau Claire, Wis.

This two-sided circular slide rule* is intended to simplify determination of pole class required for a given grade of pole-line construction. Its operation is illustrated by the following example:

Determine the class pole required for grade C construction for 175-ft. spans using 30-ft. pole with two No. 6 and three No. 4 wires on the arm at the top of the pole and two No. 2 and one No. 4 wires on the arm 2 ft. below the top of the pole. All wires are triple-braided weatherproof.

* All rights to this calculator are reserved by author.

A.C. Generator Improves Tachometer

W. H. TALBOTT
Meter Division, Westinghouse Electric & Manufacturing Company, Newark, N. J.

To date the most satisfactory method to measure the actual speeds of rotating equipments has been by means of small d.c. generator or magneto tachometers. A newly developed a.c. permanent-magnet inductor-type generator eliminates errors introduced by d.c. systems and minimizes maintenance, since no brushes or commutators are necessary.

The generator consists of two highly coercive permanent magnets, two laminated pole pieces, four coils and a laminated rotor pivoted on sealed-in-grease ball bearings.

Stator and rotor are built up from annealed high silicon steel laminations. Rotor laminations are slotted and stacked in such a manner that the completed rotor has slots running longitudinally along the periphery in a curved pattern. The rotor turns in a magnetic field provided by the permanent magnets. The slotted construction varies the reluctance of the air gap between the rotor and the stator. This in turn sets up an alternating flux which threads the voltage coils. Coil voltage produced varies with the speed of rotation of the rotor. The rotor is so designed that the alternating voltage produced is practically a pure sine wave of 60 cycles at 360 r.p.m.

Speed Range

Housing for the generator is a dust-proof and moisture-proof iron case which also shields it from stray external fields. Voltage output is accurately adjusted for 10 volts per 1,000 r.p.m. at the factory. If it is desired to recalibrate the generator, this may be done by means of a convenient adjustor bar which shunts one permanent magnet. The generator is recommended for continuous use in speed ranges between zero and 5,000 r.p.m. and for intermittent operation up to 10,000 r.p.m.

The generator may be used in any position and with any standard 400

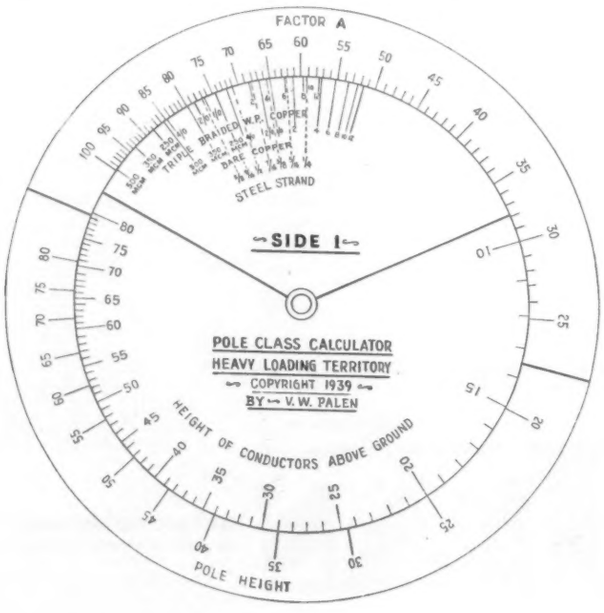
Table for Use with Pole Class Calculator

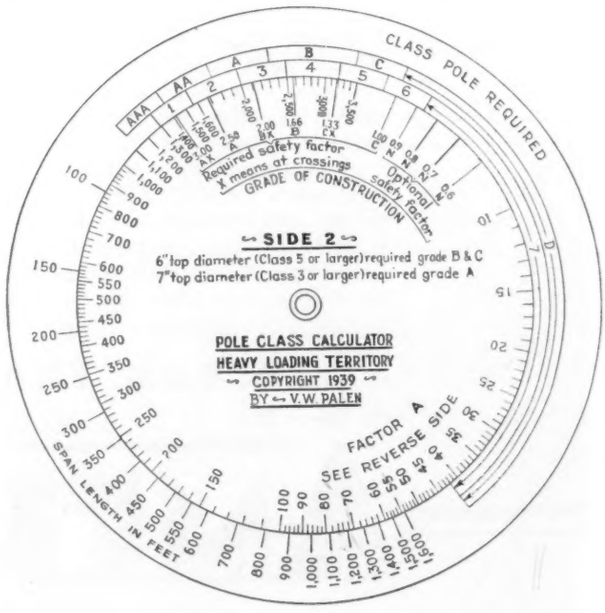
On side 1 of the calculator:

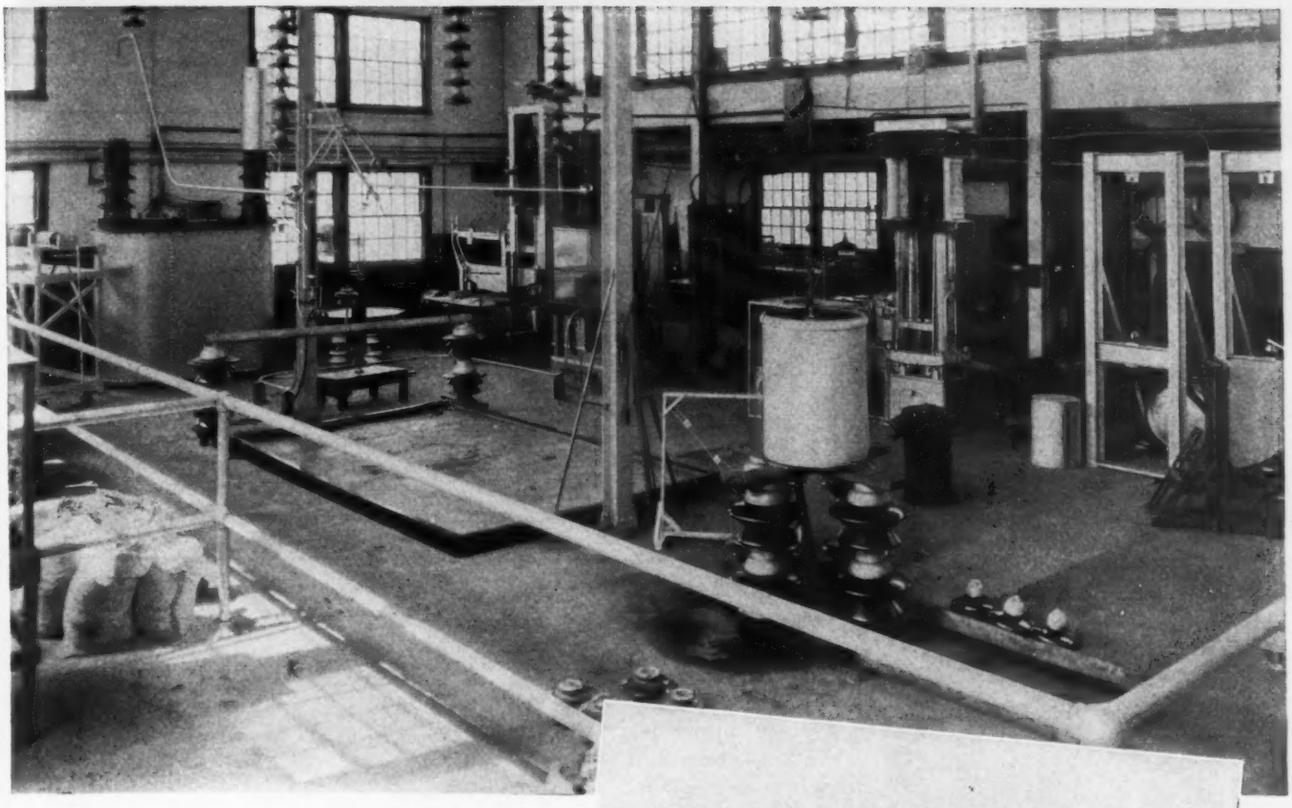
Set height of conductor from ground	Opposite pole height	Opposite wire size	Read	Multiply by	Which equals
24½	30	No. 6 WP	62.5	2	125.0
24½	30	No. 4 WP	65.5	3	196.5
22½	30	No. 2 WP	62.5	2	125.0
22½	30	No. 4 WP	59.8	1	59.8
				Factor A	506.3

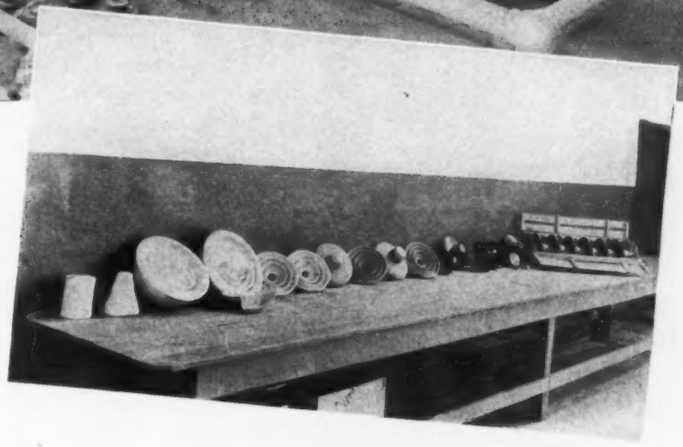
On side 2:

Set Factor A	Opposite Span	Opposite grade of construction	Read pole class
506.3	175	C	6 Answer




CLASS POLE REQUIRED
Required safety factor
X means at crossings
GRADE OF CONSTRUCTION
Optional safety factor
SIDE 2
6" top diameter (Class 5 or larger) required grade B & C
7" top diameter (Class 3 or larger) required grade A
POLE CLASS CALCULATOR
HEAVY LOADING TERRITORY
COPYRIGHT 1939
BY V.W. PALEN
FACTOR A
SEE REVERSE SIDE
SPAN LENGTH IN FEET





Where there's no Such thing as "*Good Enough*"

Insulators that can't quite make the grade never survive the exacting tests of our ultra-modern electro-mechanical laboratory. . . . From the raw porcelain pug to the completely assembled job, every step is checked and double checked by men who know what is expected of a Victor Insulator. . . . An expensive procedure of manufacture, perhaps, but in the long run it pays in lasting and safe performance on the line. We would be pleased to refer you to some critical but satisfied customers.

V

the Mark of a **GOOD** *Insulator*

VICTOR INSULATORS, INC.

VICTOR, NEW YORK

"Cope"

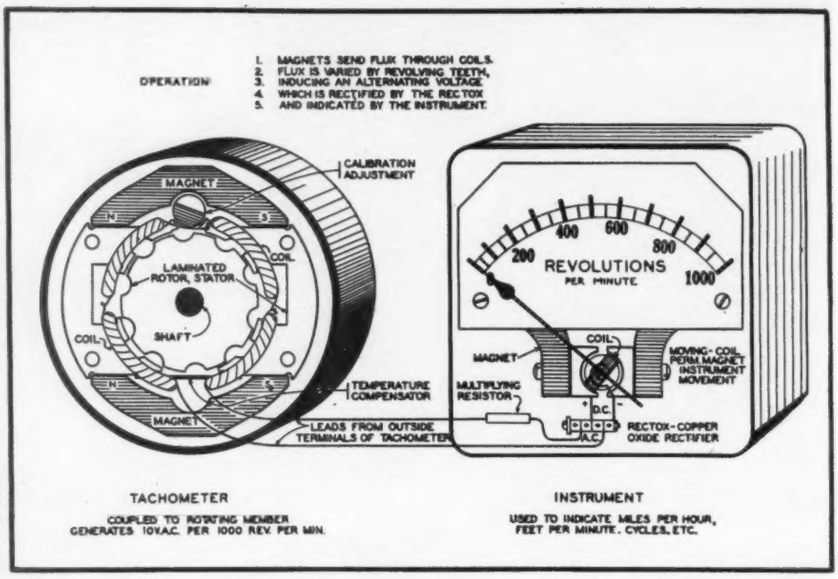
UNDERGROUND EQUIPMENT

It's the Name behind the Product that counts

For a period of over fifty years "COPE" has stood for quality in workmanship and design. We have pioneered many of the features in cable installation equipment which today have become standard in most of the principal Telephone Companies, Central Stations and Municipal Plants throughout the country.

WRITE FOR CATALOG

T. J. COPE, INC.
6120-6122 VINE STREET
PHILADELPHIA, PA.



SCHEMATIC DIAGRAM showing component parts of the a.c. tachometer generator connected to an indicating instrument

ohms per volt rectifier type portable or switchboard indicating voltmeter. Voltage output is impressed across the a.c. terminals of a four-plate copper oxide rectifier unit which is mounted within the instrument.

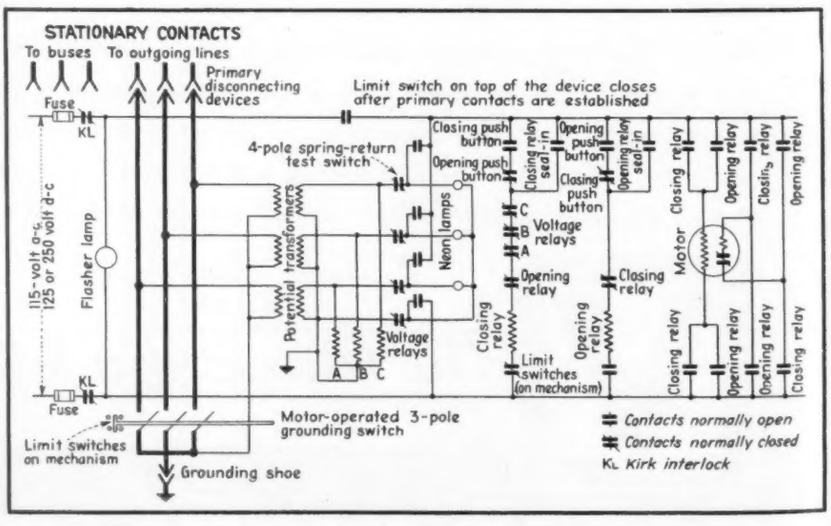
Rectified voltage is impressed across the coil of a permanent magnet moving coil type of movement. Since the voltage impressed on the a.c. side of the rectifier is proportional to generator speed, the voltmeter will indicate the true r.p.m. of the generator. The instrument need not necessarily be calibrated in r.p.m., but in units used to measure the actual speed of the prime mover.

Device Grounds Metal-Clad Switchgear

By WAYMAN A. HOLLAND
General Electric Company, Schenectady, N. Y.

A recently developed grounding device for metal-clad switchgear is a removable, metal-inclosed unit, equipped with a triple-pole, 600-amp., knife-type motor-operated grounding switch, opening and closing in air; three potential transformers, each with a neon indicating lamp, and a voltage relay with contacts that open when the circuit is energized.

Suitable for insertion into the



GROUNDING device for metal-clad switchgear is inserted into space of switchgear unit normally occupied by removable circuit breaker element. Safety features insure that line is de-energized and that only that line is grounded. Closing push button closes the grounding switch, seal-in contacts of closing relay assuring completion of operation

switchgear space normally occupied by the removable circuit breaker element, this device, like the breaker element, has primary disconnecting device studs to engage the metal-clad stationary contacts. These studs can be set to engage either the front (bus) contacts or the rear (line) contacts, as required. Once set, mechanical interlocks prevent insertion into the wrong contacts. A heavy grounding shoe makes contact with the ground bus.

To ground a circuit the equipment is inserted into the elevating cradle of the proper unit and raised into operating position. If the circuit is alive, the three neon lamps glow, as a warning to the operator. At the same time the voltage relays open their contacts, making it impossible to disregard the signal and attempt to close the ground switch.

Testing Signal Lamps

If the lamps do not glow they may be tested by switching them over to the control source by means of a spring-return test switch. If the test proves that the lamps are intact, then their failure to glow may be relied upon as indicating a circuit without potential. The operator may then close the grounding switch by means of the closing push button. A glass window at the front of the unit permits a visual check of the position of the grounding switch.

Once the circuit is grounded the device may be locked in position with a padlock, the key being kept by the foreman, or a Kirk electrical-mechanical lock may be used. Withdrawal of the key from this latter type of lock completely de-energizes the control circuit, preventing the opening of the grounding switch. A mechanical interlock prevents withdrawal of the key unless the grounding switch is closed.

Other mechanical interlocks prevent the device from being raised or lowered from the stationary contacts unless the grounding switch is open. A limit switch on the dome device closes only after the primary movable contacts have engaged the stationary contacts, as an added precaution. A flasher lamp indicates when the device is in use. If the device is equipped with a Kirk lock this lamp also indicates that the device has not been locked, since withdrawal of the key disconnects the lamp and control circuits.

WE ARE NOT *Doctors*

But We CAN CURE Some of Your

Engineering Headaches

Southern States' engineering department cooperates with men in the power industry whenever necessary. Questions we answer (and are *proud* to answer!) run the gamut of electrical queries: "What type of fuse shall I specify, and what speed of fuse link shall I use?" "Will a side-break switch best serve this purpose?" "Can you supply me with the proper substation to fill my needs?" Southern States has the answer to all these questions and those you have, too. Next time you need *real* cooperation, call on Southern States. Our engineering department is your co-worker; our factory is your warehouse.

Southern States

EQUIPMENT CORPORATION

Manufacturers of High Voltage Electrical Equipment

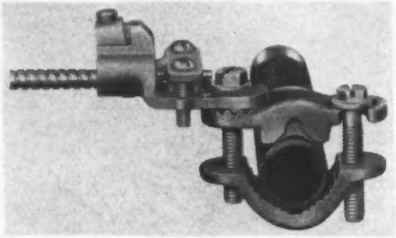
BIRMINGHAM, ALABAMA

Representatives in Principal Cities

NEW EQUIPMENT

Ground Fittings

New line of pressure connector ground fittings are available for use with conduit wiring, armored wire and unarmored wires,



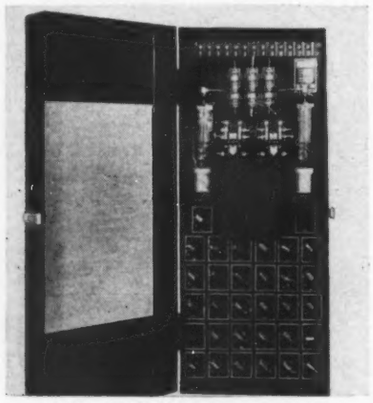
Pressure connector ground fittings: sizes; with ½ to 1-in. conduit hubs, adjustable for ½ to 1½-in. water pipe; for armored and bare wire, adjustable for ½ to 1-in. water pipe. **General Electric Co.**, Bridgeport, Conn.

to be in accordance with the requirements of the 1940 National Electrical Code. Teeth on the connector hubs and on the water pipe clamps are said to permit ground connectors to meet water pipes at any angle. The fittings are made of malleable iron and are heavily galvanized to resist corrosion.

•

Welding Controls

Three basic units comprise a new line of resistance welding heat controls utilizing electronic type of contactors in the welding equipment circuit. They are designed to take care of such applications as (1) single-weld operations, using either guns or pedestal type welders, (2) pulsation welding, requiring different amounts of current for different "shots," and (3) multi-spot welding, where individual adjustments are desired for each weld or group of welds of the series.

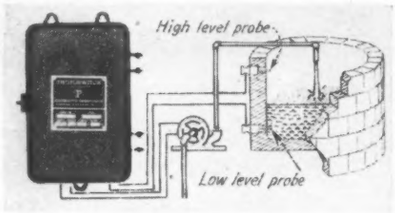


Resistance welding heat controls; model "50-Y" for current control for single welds; model "50-W" (illustrated), a multiple heat control for either pulsation or multi-spot welding; model "50-XX," an automatic heat rise control for either single-spot or pulsation welding. **Weltronic Corporation**, Detroit, Mich.

•

Level Control

Electronic level control provides "on" and "off" valve or pump control of liquids such as water, milk, nitrates, sulphates, alcohol and gasoline. Probes or electrodes are attached to tank and connected to conveniently located control with weatherproof housing. Liquid being controlled acts as a conductor at a predetermined level.



Series "P16" electronic level control; probe circuit may have a resistance as high as 2.5 megohms for control of fluids, such as distilled water and casein. **Photoswitch Incorporated**, Cambridge, Mass.

•

Bus Duct

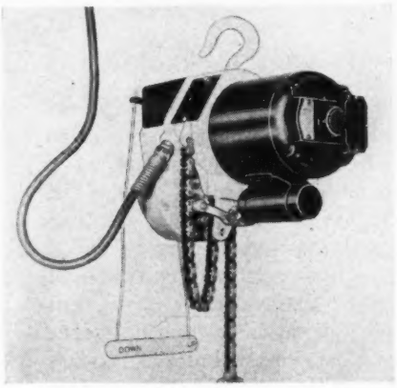
"LO-X" (low reactance) BUStribution duct; capacity range 1,000 to 4,000 amp., single and three phase, 600 volts or less, or three-phase, four-wire, 125 to 250 volts a.c., half or full capacity neutral. Available in standard lengths. **Bull Dog Electric Products Co.**, 7610 Jos. Campau Ave., Detroit, Mich.

New design of feeder type duct for busbars of large ampere capacities utilizes steel casing or duct. The design is said to reduce the voltage drop from reactance, to an even greater extent than was possible with aluminum casing. Associated fittings are available for a complete system.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Motors

New capacitor-start motors are made available for instantaneous reversing, for use on cranes, hoists, lathes and other applications. A drum switch, provided separately, when closed sets up a power circuit through a solenoid relay and motor windings. The relay transfers the circuit from a lower to an upper contact and locks the relay across the line. Line voltage across the motor main and starting windings starts the motor. When a centrifugal switch opens at a predetermined speed to disconnect the starting windings, the motor operates on the main windings as an ordinary single-phase induction motor. Motor is reversed when drum switch is thrown to the other side. Capacitor is connected on the auxiliary winding circuit.



Capacitor-start reversing motors; ratings 1/6 to ¾ hp., 1,725 r.p.m., single phase, 60-cycle, 115 and 230 volts. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

•

Coupling

Type "P" Steelflex coupling; single piloted, double piloted horizontal, and double piloted vertical. **The Falk Corporation**, Milwaukee, Wis.

A new coupling known as a "piloted coupling" has been added to the company's line. It is designed for floating shaft requirements, adaptable for use on horizontal and vertical pumps and exhaust draft fans. It consists of two hubs, one of which carries an integral flange to which the cover is secured, a special tempered steel member forming a complete cylindrical grid-member, and a flanged steel cover secured to the hub flange with capscrews.

Grand Champion

A "Grand Champion" horse in the highly trained gaited classes has won his place through proficiency in two general classifications—conformation and performance. We all know about "performance" whether it concerns horses or Pole Line Hardware, but conformation is something vastly different, though closely related.

With horses it is the shape of the head, the contour of body and legs, the placement and carriage of ears, mane and tail. A horse is *born* with it or without it. In hardware it is "design", and must be *put into* the article by someone who *knows*.

Hubbard 4-11-44 Wireholders have "clicked with judges" all over the world. Their design has been approved, tested and checked by "performance" for many years and under all conditions.

If you have not yet used the BLUE RIBBON 4-11-44 Hubbard Wireholder, you are in for a pleasant surprise. Write for a sample to look over and test—and "judge" for yourself.

HUBBARD AND COMPANY
PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

Write for Sample to
HUBBARD AND COMPANY
Advertising Department
6301 Butler St. Pittsburgh, Pa.

"HANG THE LOAD ON HUBBARD HARDWARE"

Thousands of feet
of

ORANGEBURG CONDUITS

have been installed
to insure continuity
of light and power
service so vital to
hospitals, asylums,
prisons, and other
institutions

ORANGEBURG *Standard* for installation *with* concrete encasement
NOCRETE for installation *without* concrete encasement

ORANGEBURG HAS BEEN A LASTING NAME "UNDERGROUND" FOR 48 LONG YEARS

Photograph by Nesmith

Build for tomorrow with

ORANGEBURG *Conduits*

MADE AT ORANGEBURG, NEW YORK, BY THE FIBRE CONDUIT COMPANY, 292 MADISON AVENUE, NEW YORK CITY

Sales Agent—Distributors

GRAYBAR ELECTRIC CO., INC. GENERAL ELECTRIC SUPPLY CORP.

9-FC-2

NEWS ABOUT PEOPLE

C. H. Moses New President Arkansas Power & Light

C. Hamilton Moses, who was recently elected president of the Arkansas Power & Light Co. (ELECTRICAL WORLD, September 13, page 10), started out with the company in a most unusual manner. Convinced that the company's slogan, "Helping Build Arkansas," was something he would like to help carry out, he sought employment with it back in 1919 when it was struggling through the throes of the post-war depression. He worked for two years without pay and paid all his own expenses during this time. He has been chief counsel for the company nearly 20 years.

He is the second man to be president, although the company is nearly 30 years old. Harvey Couch, who founded it in 1913, served continuously as its president until his death last July. In view of his new position, Mr. Moses will immediately sever all his other business affiliations, which are many and varied.

Born in Hampton, Ark., in 1887, Mr. Moses received his Bachelor of Laws degree from the University of Arkansas in 1911. He engaged in the practice of law and took an active part in state politics before he became attorney for the Corporation Commission, which was then the regulatory body for public utilities. It was while serving as secretary to Governor Charles H. Brough from 1917 to 1919 that he met Harvey Couch, who had begun to develop the Arkansas Light & Power Co. Mr. Moses became the closest business associate Mr. Couch had and worked with him in every undertaking he planned. Mr. Moses resigned from the Corporation Commission to enter the practice of law in Little Rock, taking over the legal business of Arkansas Power & Light Co.

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▶ PAUL R. WELDIE, who was for twenty years town manager at Centreville, Md., has recently affiliated himself with the Sussex Rural Electric Co-operative, Sussex, N. J.

▶ PAUL S. ELLISON, New York, has been appointed director of advertising and sales promotion for the Hygrade Sylvania Corp., Salem, Mass., reporting to W. E. Poor, executive vice-president.

▶ WILLIAM L. BATT, president of SKF Industries, Inc., and director materials division, Office of Production Management, has been appointed a member of the five-man mission appointed by President Roosevelt to represent the United States in a three-power conference in Moscow, Russia.

▶ ARTHUR P. HIROSE, director of market research for the McCall Corporation, has been appointed director of promotion for the corporation. Prior to joining the McCall organization he was manager of the sales promotion and market analysis departments of ELECTRICAL WORLD and other McGraw-Hill publications. He will retain his duties of market research in addition to his new work.

L. B. Round Elected Head of Pennsylvania Group

Louis B. Round, who was elected president of the Pennsylvania Electric Association at the recent convention at Bedford Springs, Pa., has been vice-president and general manager of the Pennsylvania Power Co., New Castle, for the past ten years. The assumption

of these executive duties in 1931 marked the promotion of Mr. Castle from the status of a local manager to the directing head of the company.

Born in England, Mr. Round came to this country at an early age. It was in 1907 that he joined the New Castle Electric Co. as a meter reader. After serving in various capacities, he was appointed assistant superintendent of the Pennsylvania Power Co. in Ellwood City and in 1917 upon the consolidation of the New Castle and Ellwood districts, he was made assistant superintendent. In 1918 he succeeded J. C. Chestnut as the manager of the New Castle district.

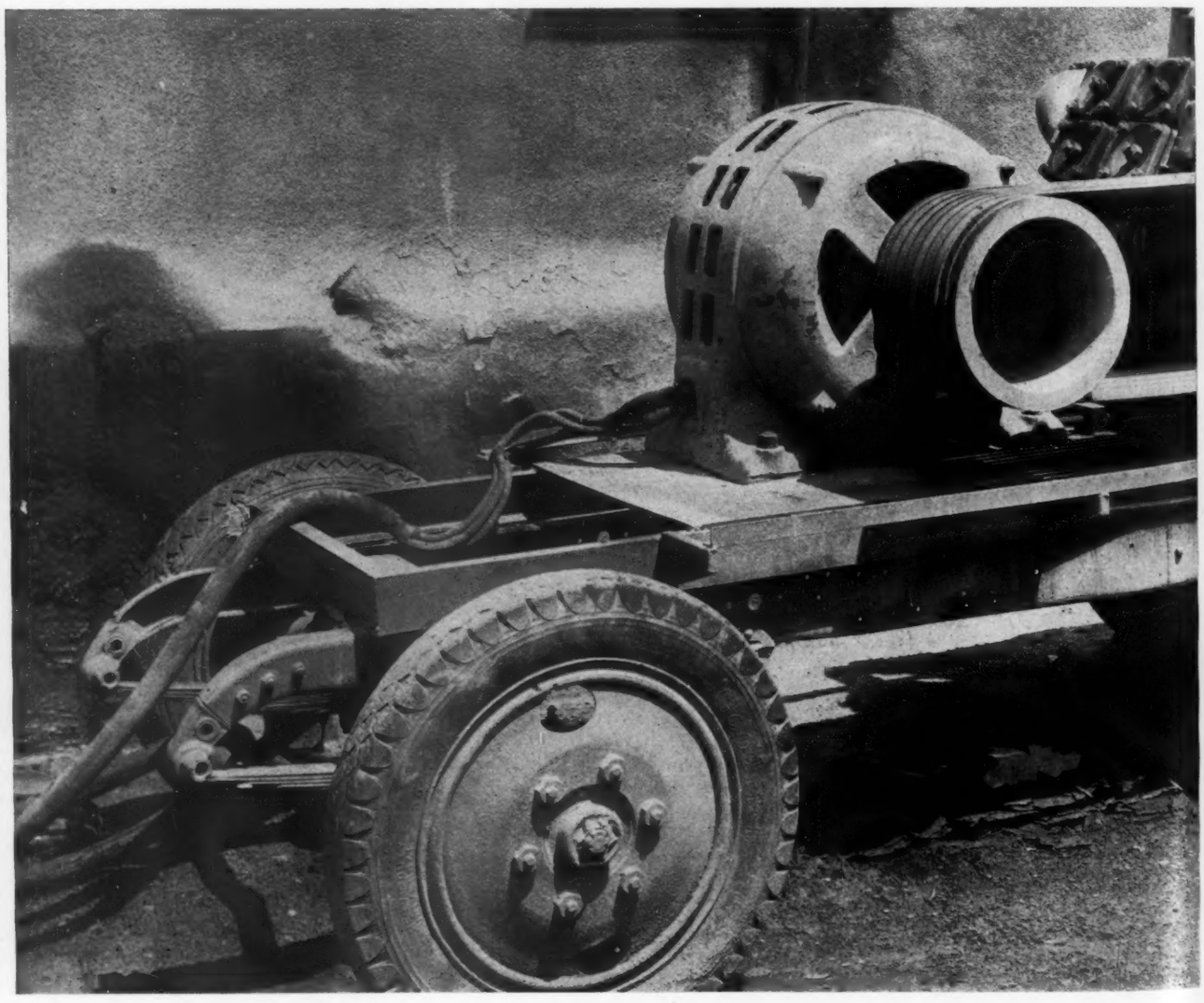
•

▶ JAMES A. SMITH has joined *Newsweek* as regional research director with headquarters in Chicago. Before join-

..."ON COLD MORNINGS OUR COMPRESSORS OFTEN BLEW FUSES...

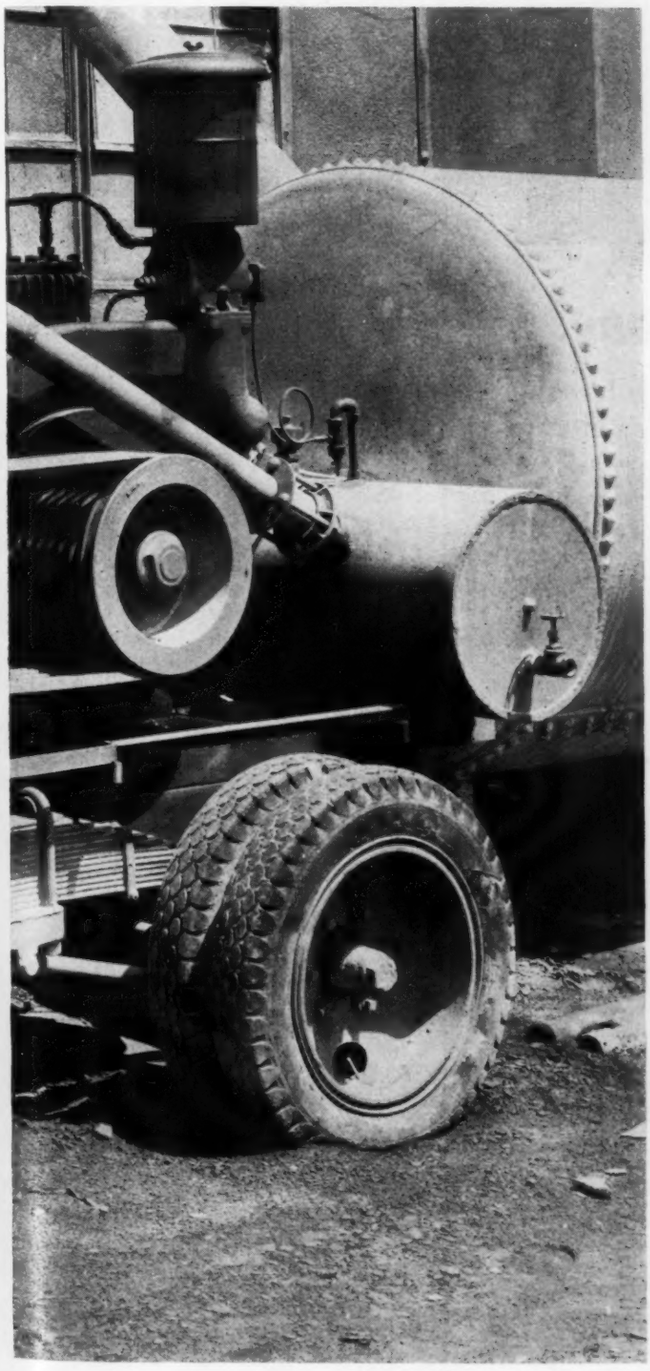
Then we installed *BUSS Super-Lag FUSES* and cured the trouble"

O. S. GREGORY, Electrician
DEWEY PORTLAND CEMENT CO., DAVENPORT, IOWA



"We use three portable compressors, powered by 3 phase 60 cycle 440 volt motors," continues Mr. Gregory. "These compressors stand outdoors all the time. On cold mornings after they have not been used all night the oil in them is very stiff. This causes a heavy starting load and the resulting current surge often blew fuses—which interfered badly with getting work under way.

"About 1936 we installed BUSS Super-Lag fuses. We find they hold where other fuses failed. They proved a practical cure for shutdown troubles.



If Useless Shutdowns Cause Work Stoppage in Your Plant—Maybe Buss Fuses Can Help You Too

In the case cited by Electrician Gregory it is the time-lag built into the BUSS Fuse-Link that permitted compressors to start under the same conditions that had formerly caused ordinary fuses to blow.

The "lag-plates" attached to the BUSS Fuse-Link are responsible for this desirable time-lag. Unusually heavy starting currents or other harmless overloads seldom cause BUSS Super-Lag fuses to open—yet with all this time-lag they will operate under heavy overload or short-circuit conditions as safely as any fuses made.

Fuse-Case Design Also Helps Prevent Shutdowns

It takes more than time-lag to prevent needless blows. Poor contact must be prevented, otherwise excess heating will soon raise the temperature of the link and cause it to blow needlessly. Then the circuit is out and the user is penalized by a useless shutdown.

The BUSS Fuse-Case is designed to insure good contact on the link, even when renewed by an inexperienced person—and is so designed that vibration or heavy overloads or constant heating or cooling of the fuse will not permit poor contact to develop.

Given good contact in the clips BUSS fuses will always carry their rated load and will not open needlessly no matter how long they are in service.

Act on the Facts

If you are interested in preventing many "false-alarm" blows that are entirely unnecessary—

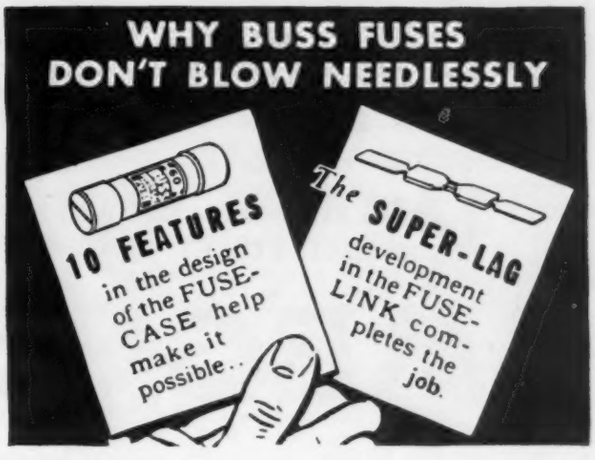
If you want to keep things humming and save needless waste of maintenance time—

If you believe that a protective device should protect against senseless interruptions of electrical service as well as against electrical hazards—

You will find it to your advantage to act at once and standardize on BUSS Super-Lag Renewable Fuses.

Bussmann Mfg. Co., University at Jefferson, St. Louis—Division McGraw Electric Company

BUSS Super-Lag FUSES


WHY BUSS FUSES
DON'T BLOW NEEDLESSLY
10 FEATURES
in the design of the FUSE-CASE help make it possible..
The SUPER-LAG
development in the FUSE-LINK completes the job.

Take Time to Test

Now is no time for electrical insulation failures that can tie up production. Wise maintenance programs regularly schedule brief "time-out" for testing the insulation of all important machines, cables and control equipment.

And of equal importance in many installations are measurements of ground connection resistances, for safety, and to avoid trouble due to lightning and other system disturbances.

Biddle Bulletins on Preventive Maintenance

- *Pocket Manual of "Megger" Practice No. 1420 EW*
- *On the Use of Hand Driven "Megger" Testers, Bulletin 1655*
- *Ground Resistance Testing, Tech. Bulletin 1285*
- *"Ducter" Ohmmeter (used on Circuit Breakers) Bulletin 1635*

When writing, please mention this Advt. No charge.

The above picture is by courtesy of the Hartford Steam Boiler Inspection and Insurance Co. This and other large Insurance Companies protect their risks—and your plant—by systematic inspection and testing, in which our "Megger" Instruments play a fundamental part.

These remarkable testers, with self-contained hand-cranked generators, have served industry for more than 35 years. You make no mistake when you select them.

JAMES G. BIDDLE CO.
1211-13 ARCH STREET • PHILADELPHIA, PA.

"MEGGER"

TRADE MARK REGISTERED U S. PAT OFF

ing *Newsweek* Mr. Smith was, for two years, manager of the industrial sales division of the Burndy Engineering Co. Prior to that connection he spent four years as sales promotion manager of Anaconda Wire & Cable Co.

•

R. H. Barclay Joins Staff of J. G. White Corporation

Robert H. Barclay, who recently resigned as regional director of the Federal Power Commission, New York, N. Y., a position which he had held since 1936, has been engaged by the J. G. White Engineering Corp. as electrical engineer in charge of the division of electrical engineering.

Kaiden-Keystone

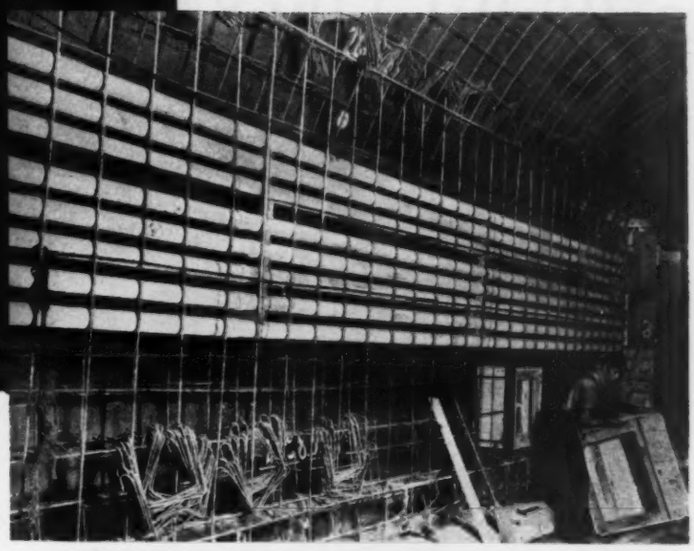
Early in his career Mr. Barclay spent three years in the telephone industry. Following connections with the Kansas City Terminal Railway Co. and the Brooklyn-Manhattan Transit Corp., Mr. Barclay became chief electrical engineer for The Foundation Company, New York, in 1917. He joined Starrett and Van Vleck, architects, New York, as chief electrical engineer, in 1922, and in 1924 became electrical engineer for the Stone & Webster Engineering Corp., Boston, Mass. From 1931 to 1934 he was president of McClelland Barclay Art Products, Inc., and in 1934 became affiliated with the Federal Power Commission, Washington, D. C., as chief of the analysis and reports division of the National Power Survey.

•

▶ O. K. MARTI, engineer in charge of the rectifier division of Allis-Chalmers Manufacturing Co. has been appointed consulting engineer of the company's rectifier division, according to a recent announcement by Max W. Babb, president. "In the present circumstances," said Mr. Babb, "we feel that Mr.

An Important Factor in

REDUCING DISTRIBUTION COSTS...



BANKHEAD VEHICULAR TUNNEL, Mobile, Ala. In this recently completed tunnel, 40,000 feet of J-M Transite Korduct are used to carry power cables. *General Contractors:* Arundel Corp., Baltimore, Md. *Electrical Contractors:* Miller Electric Co., Jacksonville, Fla.

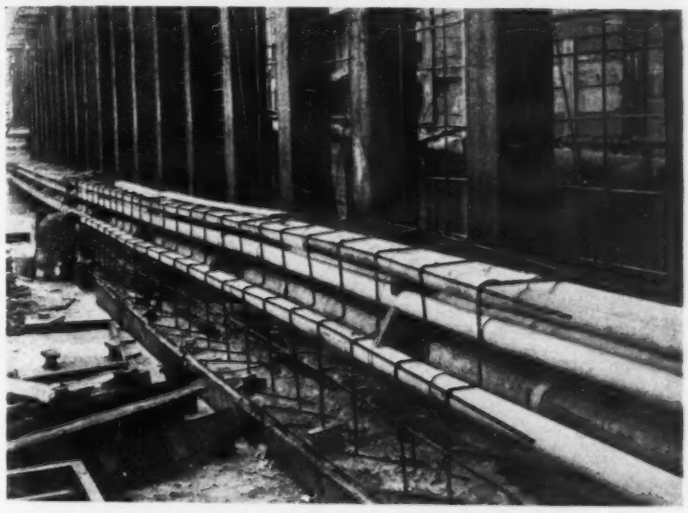
TRANSITE KORDUCT—made of asbestos and cement—helps keep maintenance and operating costs permanently low

Wherever a duct system must be "concreted-in," there you will find worth-while economies possible with J-M Transite Korduct.

Installation goes faster and costs less, for this modern duct is light in weight . . . easy to handle and assemble. Its long lengths line up accurately . . . minimize the number of joints required in the line.

And these savings are further increased year after year. Being fireproof and rotproof, Transite Korduct seldom requires maintenance. Its asbestos-cement composition provides a high rate of heat dissipation. Cables run cooler . . . copper losses are reduced. As a result, the carrying capacity of the system is markedly increased and the system will show a greater return per dollar invested.

You will want to keep all the facts on file. Write for brochure D. S. 410. Johns-Manville, 22 East 40th Street, New York, N. Y.



MADE OF ASBESTOS AND CEMENT, Transite Korduct will not burn. It never contributes to the formation of combustible or explosive fumes. And because it is rotproof, maintenance costs stay low.

JM Johns-Manville

TRANSITE DUCTS

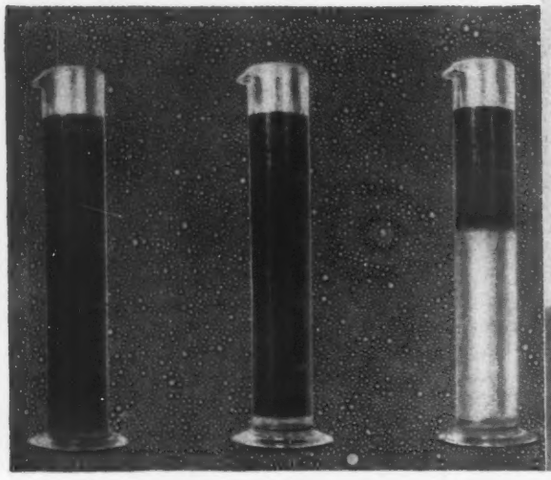
TRANSITE KORDUCT . . . for installation in concrete.

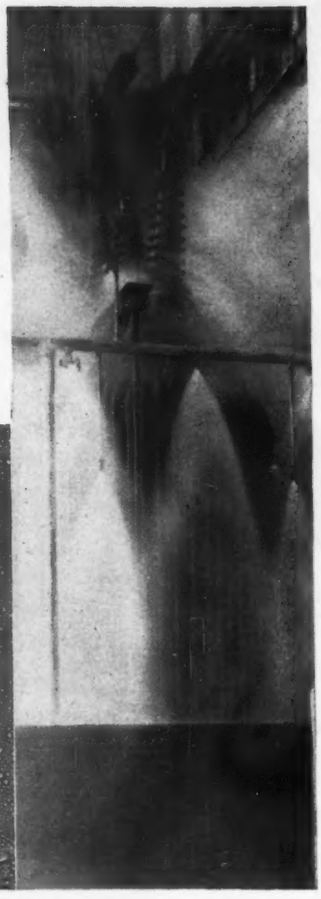
TRANSITE CONDUIT . . . for exposed work and for installation underground without concrete encasement.

AND FOR USE WITHOUT A CONCRETE ENVELOPE—J-M Transite Conduit

Identical with Transite *Korduct*, except in wall thickness and price, Transite *Conduit* is ideal where "concreting-in" is not specified. So strong it needs no protective casing, Transite *Conduit* saves time and money on every job. Its asbestos-cement composition is highly corrosion-resistant; maintenance stays permanently low.

STOP OIL FIRES in 2 to 5 seconds!





Mulsifyre spray turns oil to non-flammable emulsion (left). Within 5 minutes, oil starts separating out (center). In 5 hours, complete separation leaves oil undamaged (right).

Install Mulsifyre Systems that churn oil into Non-flammable Emulsion!

This fixed equipment is always ready for instant action through manual or automatic opening of a valve!

It is the only system that kills fire speedily, positively by the unique principle of mulsifying oil with a driving spray of water. On transformers, turbines and other oil-filled equipment, Mulsifyre Systems snuff out fire before smoke or heat can cause heavy damage. No danger of wind interference . . . no chance of spontaneous re-ignition.

Approved and installed by leading utility companies the world over. Investigate this effective way to end fire hazards. Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities.

WRITE FOR *this 76-page booklet by Underwriters Laboratories explaining Mulsifyre Systems in detail.*

GRINNELL

Automatic Sprinkler Fire Protection

Marti's capacities should be devoted exclusively to research and development work and, for that reason, he is being relieved of other routine duties." Mr. Marti was born in Switzerland, where he received his schooling, and was graduated from the Government Technical University at Zurich in 1916 with master's degrees in electrical and mechanical engineering. He came to the United States in 1920, where he became research assistant and member of the electrical engineering faculty at Cornell University, Ithaca, N. Y., and later was made research engineer and then chief engineer of the American Brown Boveri Electric Corp., Camden, N. J. When that company was taken over by the Allis-Chalmers company in 1931 Mr. Marti joined the latter organization. H. WINOGRAD, who studied under Mr. Marti at Cornell University and joined him upon graduation at American Brown Boveri Corp. and at Allis-Chalmers in 1931, is appointed engineer in charge of rectifier design, in which capacity he will continue with his present work as well as taking on the duties which Mr. Marti is relinquishing.

► A. A. BROWNE, steam engineer for the Pacific Coast district of the Westinghouse Electric & Manufacturing Co. for the past two years, has been appointed assistant manager of the company's central station and transportation divisions for the Pacific Coast district. He will make his headquarters in San Francisco. As district steam engineer, Mr. Browne has had wide experience with virtually all phases of the electrical industry, particularly with the big steam turbines. He has been connected with Westinghouse since 1930.

► HARRY E. HUFF, for many years assistant manager of General Electric lamp department's Empire division at Buffalo, N. Y., has been appointed manager of that division. E. F. STRONG, who long has served as manager has resigned, but will continue at Empire division in an advisory capacity. Mr. Huff assumes his new duties equipped with a broad and varied background of experience in the engineering, sales and executive branches of the lighting and lamp phases of the industry.

► GEORGE S. WHITLOW has entered the electrical engineering department of the Union Electric Co., St. Louis, Mo., in the capacity of electrical engineer. Following graduation from the University of Arkansas in 1924, Mr. Whitlow joined the General Electric Co., serving with distinction in Schenectady, Philadelphia, and for the past twelve years in St. Louis as central station application engineer. He has performed engineer-

ing services for numerous power companies and large industrial organizations in Arkansas, Missouri, Illinois and western Tennessee. He is a member of the American Institute of Electrical Engineers.

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▶W. HOMER REEVE, who has been serving as acting sales manager of Easy Washing Machine Corp., Syracuse, N. Y., has been appointed sales manager of the company. He assumes complete responsibility for Easy's sales and merchandising activities. Mr. Reeve joined Easy two years ago to direct an extensive dealer development program for the corporation. Previously he had served for several years as a sales executive with the Frigidaire Corp. in the household division.

▶C. D. ALBRIGHT of Portsmouth, Ohio, has been appointed district superintendent of the Ohio Power Co. at Bucyrus to succeed JOHN BOYD, who has held the position for the past twenty years. Mr. Boyd has retired after an association with the company covering a period of 30 years.

▶CLINTON E. MILLER has been elected president of the Los Angeles, Calif., Board of Water and Power Commissioners to succeed James B. Agnew. C. CLARKE KEELY is the newly elected vice-president, filling the vacancy caused by the resignation of William B. Himrod.

▶DEAN HARVEY, materials engineer of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has been elected vice-president of the American Society for Testing Materials.

▶T. E. ROACH, formerly president of Washington Gas & Electric Co., Tacoma, has been named assistant to the president of Pacific Power & Light Co. to supervise and co-ordinate the operations of the Washington districts under the direction of the vice-president and general manager. In his new position, Mr. Roach will make his headquarters in Yakima, center of Pacific Power & Light Co.'s system in central Washington. CHARLES M. SANFORD, secretary of Pacific Power & Light, has been named assistant general manager to supervise and co-ordinate the operations of the Oregon districts. Mr. Sanford's headquarters will remain in Portland. He has been with the company for many years. J. G. HAWKINS, for some years treasurer and chief accountant, will be secretary and treasurer. H. W. DERRY, manager of the new industries department, will continue as head of this department, but his headquarters will be transferred from Portland to Yakima.

PIONEER OF THE *Cedar* INDUSTRY

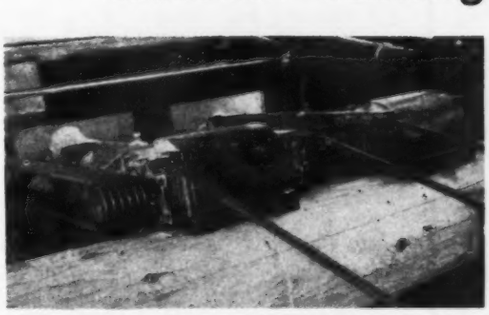
- BUILT THE FIRST BUTT TREATING UNIT IN 1907
- PIONEERED CUSHION MACHINE INCISION
- FIRST WITH THE CONCAVE GAIN
- FIRST WITH THE SLAB GAIN
- FIRST TO OFFER THE FINISHED CEDAR POLE

originated the machine shaving process to insure added service life in cedar

To eliminate the hazard of shell rot and lengthen the life of cedar poles above the groundline, Valentine Clark pioneered the design of a machine to remove excess sapwood. This shaving machine reduces the sapwood thickness from groundline to extreme top of the pole so that not over a ½-inch layer remains. This is important in the prevention of decay as rot begins where the sapwood is thick and moisture is retained.

DURAPOLE

the first Cedar Pole to give users the many benefits of machine shaving



This shaving machine was pioneered and perfected by for full length shaving of Cedar Poles — it was the first of its kind. This process, together with full length treating, gives you much more for your pole dollar—some of the benefits are: extended service life above ground — absolute safety for linemen — enhanced appearance — more efficient inspection — better public relations — lower pole maintenance costs.

The DURAPOLE — full length machine shaving and full length creosote treatment gives you a cedar pole with definite increased service life over the standard butt treated pole.

The DURAPOLE, because of full length creosote treating, has much improved appearance in its smooth surface and chocolate brown color.

The DURAPOLE is slab gained to insure perfect drainage — to save on maintenance — to add to appearance—and to make possible secure arming.

The DURAPOLE has ½" guaranteed penetration butt treatment—no reduction in sapwood in butt section.

IT PAYS TO SPECIFY

DURAPOLE

VALENTINE CLARK CORPORATION

2516 DOSWELL AVE. . . . ST. PAUL, MINN.

84 William St. New York City | Western Yard and Treating Plant Newport, Wash. | Dwight Building Kansas City, Mo.

NEW
GREENLEE
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TOOLS TO MAKE THE ELECTRICIANS' JOB EASIER

- HYDRAULIC CONDUIT BENDERS
- TUBE BENDERS
- KNOCKOUT TOOLS
- CABLE PULLERS
- PUSH DRILLS
- BORING TOOLS
- SPIRAL SCREW DRIVERS
- HYDRAULIC PIPE PUSHERS

Here's the new Greenlee Tool Catalog 33-E that every user of tools in construction and maintenance work should have. This handy buying guide has been compiled to make it easy to select the right tools for the job . . . tools designed to make it easier and faster for the man on the job. Write today for your free copy of this valuable reference of Greenlee Hand Tools for the electrical worker. You'll learn how these tools can help make your job easier.

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OBITUARY

E. A. Feldtkeller

E. A. Feldtkeller, president of the Virginia East Coast Utilities, Inc., West Point, Va., died at his home in Richmond on August 28. He was 48 years of age.

Mr. Feldtkeller had centered his business activity in West Point during the spring of 1939 when the general offices of the Virginia East Coast group were moved there from Richmond. Mr. Feldtkeller was born in Milwaukee in 1893 and studied electrical engineering at the University of Wisconsin. Entering the employ of the Commonwealth Power Co. of Milwaukee as an engineering cadet, he became general superintendent of the company, leaving in 1916 to join the Globe Electric Co.

of Milwaukee. During the war Mr. Feldtkeller was engaged in war industries in the Middle West. He went to Virginia in 1919 as general manager of the Alexandria Light & Power Co. In 1926 and 1927 Mr. Feldtkeller was vice-president of the General Engineering & Management Corp. of New York City. Subsequently he served as vice-president and general manager of Jersey Central Power Co., Asbury Park; executive vice-president of Southern Ohio Public Service Co. and in 1929 he became an officer and director of the East Coast system. He was elected president of the company in 1935.

•

▶ ALFRED H. DYSON, patent attorney of the Allis-Chalmers Manufacturing Co. and well known in the electrical industry since his earlier association with many large eastern organizations, died, of a heart attack, while fishing on a northern Wisconsin lake on September 7. He was 65 years old. Mr. Dyson was probably best known for his work in the field of automatic telephony, where as a research engineer and patent attorney, he obtained more than 50 patents. He became affiliated with Allis-Chalmers in 1931, when the American Brown-Boveri Co., with which he was then connected, was absorbed by the Allis-Chalmers Co. Previous to that time he was associated with the Kellogg Switchboard Co., Automatic Electric Co., Western Electric Co., Bell Telephone Laboratories and the Federal Telephone & Telegraph Co.

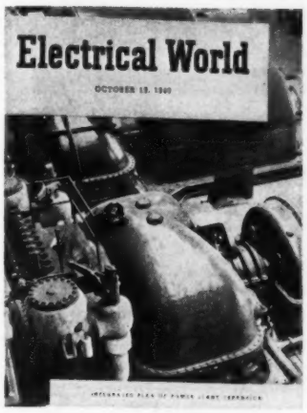
▶ CHARLES H. ROBERTS, treasurer of the Johns-Manville Corp., died in Doctors Hospital, New York, on September 10 of a heart ailment. He was 51 years old. Mr. Roberts began his business career in 1907 with John A. Roebling's Sons Co. as head of the cost department. Later connections included U. S. Rubber Co. and the Splitdorf Electrical Co. He joined Johns-Manville in 1928.

▶ ERNST J. BERG, eminent mathematician and electro-physicist, and for many years a co-worker of the late Charles P. Steinmetz, died on September 9 at the age of 70. Dr. Berg retired in June after 28 years as head of the electrical engineering department at Union College, Schenectady. He had served as consulting engineer with companies in the United States, England, France, Germany and Italy. Born in Sweden he was educated in Stockholm and came to this country in 1892 as an assistant to Dr. Steinmetz. In 1904 he became a consulting engineer with the General Electric Co. and three years later joined the electrical engineering faculty at Union College. After two years he was named head of the electrical engineering department at the University of Illinois and remained there until his return to Union in 1913. He became dean of engineering at Union in 1932. His contributions to engineering science were in the field of rotary converters, disturbances on power transmission lines, and electromagnetic radiation.

▶ HAROLD J. STEIN, director of research, chemistry and metallurgy of the Allis-Chalmers Manufacturing Co., Milwaukee, died September 9 at the age of 49. Mr. Stein directed these activities since 1939 when they were consolidated into one department upon retirement of R. S. MacPherran, chief chemist. As a student apprentice, Mr. Stein went to Allis-Chalmers in 1916 where he served in several manufacturing departments and was successively general foreman of heat treating operations, assistant foreman of the forge department, and later research engineer. He was made chief research engineer of all manufacturing departments of the company in 1936.

Thanks to You

Electrical World continues to be the most VITAL magazine in its field.



YES, thanks to your cooperation with our editors, and with the trained inquirers whom McGraw-Hill sends out to interview readers, Electrical World continues to provide active leadership.

For, together with other McGraw-Hill publications, Electrical World has established a program of editorial research conducted by a staff of especially trained men. These interviewers make personal calls on subscribers at work in the field and in their offices in all sections of the country—to find out from them why they read Electrical World, how they use it, what they like best, what they pass up.

On each visit, a specific issue is gone through from cover to cover, and every page, every item, is weighted according to its value to the interviewed subscriber.

An original and farsighted step in journalistic practice, the idea behind the plan is to help the editors better to gauge the needs of subscribers so that they may provide a progressively better service.

This program can be successful only through your cooperation. Thanks to you, it has already been of tremendous help to our editors; and we are confident that the benefits of these interviews will be felt throughout Electrical World's readership.

In the hope that readers may find suggestions for new uses and applications for the magazine in the comments of other readers, we are publishing some of the remarks made during interviews held so far.

READER COMMENTS

"The type of article most useful to me is of a general lighting and merchandising nature. The news issue always interests me and the Personal section helps keep me up to date on the more important organization changes."

★

"'Street Lighting in Kingston'—That's right in my line. I copied some of the figures in there. We're about to go into a street lighting campaign so this article was doubly interesting."

★

"Had an interesting article about a year ago on Glass tape. Fact that salesman came through about same time made it more interesting. Knew about it before he arrived, thanks to E. W."

★

"Distribution Problems—very helpful pointers on different ways of doing. For instance, the article they had about Detroit—I followed out their idea and it's been directly helpful in many ways."

★

"Off peak water heaters—had a very interesting article about measuring the number of gallons of hot water used at time of peaks. Had a meter, but never knew at what time or how much the peaks were. The article straightened us out on this all right."

★

"My copy is made available to my men, most of whom read it with regularity. Articles of interest to my department are not only read by my men but clipped and filed under appropriate subject head."

★

"Capacitors Release—This was right in my line—good articles. Commercial Cooking—I'm interested in load building. Editorials—I always read those, I like to get the editor's slant. Operating Practices—I usually find some pretty good information in this. Those outdoor regulators they have in Lynn interested me particularly. I think the magazine is pretty well balanced but of course I can always read more on distribution."

Electrical World

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MANUFACTURING-MARKETS

TVA Lets Contracts for New Equipment

Contracts for five more waterwheel generators to keep pace with the rapidly increasing power demand of defense manufacturing in the area it serves have been awarded by the Tennessee Valley Authority to the General Electric Co. The five generators ordered are for the Kentucky Dam and power site located on the Tennessee River in Marshall and Livingston counties, about 26 miles from Paducah, Ky.

The generators will be built at General Electric's Schenectady Works. Each will be rated 32,000 kw., operating at 78.3 revolutions per minute. It is expected that the first of the five units will be installed and ready for operation in the latter part of 1943. The fifth will be installed and ready for operation by the middle of 1944.

Other contracts let recently by TVA include five hydraulic turbines and governors, Allis-Chalmers Manufacturing Co., $3,362,400, for Kentucky Dam project; for Watts Bar Dam station, two generators, Westinghouse Electric & Manufacturing Co., $958,490; and two hydraulic turbines and governors, Baldwin Southwark division, Baldwin Locomotive Works, Inc., $1,095,076; for Wilson Dam station, two hydraulic turbines and governors, Allis-Chalmers Manufacturing Co., $424,200.

•

Electric Range Standards

Realizing the need for adequate provision in the design and construction of electric ranges to permit the use of plug and cord attachment to the electric circuit, and for a uniform height of electric ranges, the following NEMA approved standards were recently adopted:

Standard dimensions of wall space for ranges—height, not less than 8 in. from the floor; width, not less than 8 in. on each side of the center line of the range; depth, not less than 5¾ in. in from the back of the range.

Standard height of an electric range —36 in. from the floor.

•

Diehl Company to Build $1,000,000 Plant

Diehl Manufacturing Co., Elizabeth, N. J., has authorized immediate construction of a new plant at Finderne (Bridgewater Township), N. J., where part of a 300-acre tract acquired by the company a number of years ago will be used. Plant will consist of several large one-story units for parts production and assembling. Facilities will be provided for employment of approximately 1,300 persons.

It is expected that completed plant, scheduled for 1942, will be used initially for production of equipment for the government. Cost is reported close to $1,000,000. Austin Company has been engaged to design and erect the new plant.

•

Material Substitutions

Chromium-plated copper will be used by General Electric Co. as a substitute for Alzak finished aluminum for reflectors on sodium luminaires, Form 79 luminaires and some floodlights. This substitution is made in co-operation with the defense program to conserve aluminum wherever substitutions can be made without impairing the quality and efficiency of the product.

•

Appointed to OPM Group

Two of the newly appointed members of the OPM automotive defense industry advisory committee represent electrical companies. They are C. S. Davis, president Borg-Warner Corp., Chicago, Ill., and D. J. Eby, vice-president Wagner Electric Corp., St. Louis, Mo.

Fines Imposed on Bulb Manufacturers

Judge John Bright in United States District Court of New York last week imposed fines totalling $47,000 on two American companies, a Dutch organization and five individuals charged with restraining trade in the importation and sale of glass bulbs used for incandescent lamps.

The war abroad has made it impossible to import glass bulbs from the Netherlands and the five defendants merely pleaded *nolo contendere* (no contest).

Fines of $10,000 were imposed upon Corning Glass Works, and of $5,000 each on three officers of the company; General Electric Co., $10,000; N. V. Phillips of the N. V. Phillips' Gloeilamperfabriken of the Netherlands, $10,000 and two officers of the Netherlands concern, $1,000 each.

•

New Addition at Belden Plant Nears Completion

A new addition to the Richmond, Ind., plant of the Belden Manufacturing Co. is expected to be completed and ready for use by October 15, it was announced recently by Whipple Jacobs, president. The addition, which comprises approximately 31,000 sq.ft., will be used for the manufacture of both bare and tinned wire.

Approximate cost of the building, electrical station, new stoker and operating equipment is $125,000, and production machinery to be used in connection with this project is valued at about $200,000.

•

Work Advances on Mills

Full operation by July of next year is expected for the new seamless brass and copper tube and rod mills to be

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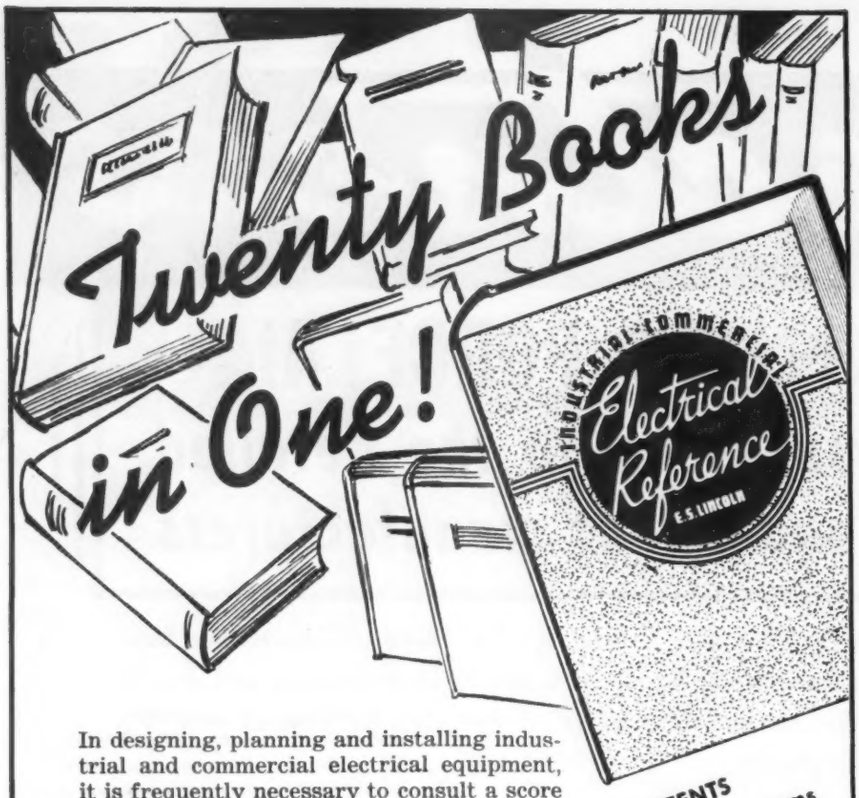

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operated by the Phelps Dodge Copper Products Corp. in the Los Angeles area, according to an announcement by Wylie Brown, president. According to present plans, the plant will provide about 175,000 sq. ft. of manufacturing space. Its construction will be financed by the Defense Plant Corporation and will be leased to Phelps Dodge.

•

Revere Earns $2.86 in First Half Year

For the six months ended June 30 Revere Copper & Brass, Inc., reports a net profit of $2,363,884, subject to year-end adjustments. In determining this amount there has been deducted a provision amounting to $5,420,000 for federal taxes on income, which provision has been estimated on the basis of tax amendments now being considered by Congress.

This net profit after provision for taxes compares with profit for the similar period of 1940 of $1,287,894. Net profit for the first six months of 1941 is equal to $2.86 per share on the common stock outstanding, after providing the semi-annual requirements on 7 percent and 5¼ percent preferred stock and $2 per share on the class "A" stock.

Other manufacturing companies reporting operations follow:

AMERICAN INSULATOR—Six months to June 30, net income, $100,675, after federal and state income and excess profits taxes of $113,800, against $57,091, after corresponding taxes of $26,675 last year; net sales, $1,275,717, against $675,214.

FAIRBANKS, MORSE—Including subsidiaries, six months ended June 30, net profit after provision of $1,720,000 for federal income and excess profits taxes, $1,382,499, equal to 2.30 each on 599,595 shares of common stock, compared with $948,177, or $1.58 each on 600,000 shares of stock, in first half of 1940. The company said provision for Federal taxes included estimated increase in 1941 levy.

NASH-KELVINATOR—June quarter, net profit after provision for normal and excess profits taxes, $2,606,589, compared with $901,939 earned in same quarter of 1940. Nine months to June 30, net profit, $3,734,246, compared with $1,307,878 for nine months to June 30. Corporation has government contracts and commitments for facilities for and production of defense materials approximating $85,000,000.

New York Metal Prices

	Sept. 16,'41 Cents per Pound	Sept. 10,'41 Cents per Pound
Copper electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.85	5.85
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spots	7.64	7.64
Tin, Straits	52.00	52.00
Aluminum, 99 percent	17.00	17.00

* Delivery Connecticut Valley.

Field Reports on Business

Defense contracts continue to be awarded for a wide diversification of material in various sections of the country. Shortages and priorities, however, are curbing to a certain extent the spurt in business which generally occurs in September. Average weekly earnings are increasing. Retail trade continues active.

CHICAGO

Despite the irregularities which developed during the past month, business in general continues to move forward at a record-breaking pace. Industrial production held fairly steady last week while retail trade declined from the previous week, due mostly to the labor day holiday. Wholesalers reported a heavy demand for all types of merchandise with electric appliances moving rapidly.

Strenuous efforts are being made to stave off impending plant closures in non-defense lines because of material shortages. Nearly 1,000 representatives of small manufacturers met here this week to set up a program for securing defense sub-contracts or the necessary materials to continue operations.

Forty-two central plant air-conditioning systems totaling 499 hp. were installed during August compared with 27 installations aggregating 237 hp. in the same month last year. Sales of electric room coolers last month were 223 as against 94 in August, 1940.

Defense contracts awarded in this area for electrical equipment included wire and cable, $29,464; furnaces, $17,283; lighting equipment, $40,159; motors, $38,304; switchboards, $65,035; switchboxes and coil cases, $59,263.

NEW YORK

Recovery from the holiday week-end has become evident in industry as aggregate production swings back to the recent high levels. Under the pressure of shortages and priorities, however, the seasonal expansion usual in September will probably not be realized this month.

Average weekly earnings in the defense industries are increasing at a greater pace than are the hours worked per week, and this is true in many non-defense industries also.

Retail trade in the New York area continues active, but is failing to show the pronounced percentage increase over a year ago that marked August.

No seasonal decline in sales by manufacturers was experienced by the vacuum cleaner industry through the summer, distributors have reported. In July and August volume was up about 100 per cent, and while the September rate of gain is not so large, this is due chiefly to lagging deliveries.

NEW ENGLAND

Betterment in the situation of many small industries in this area that are engaged in the manufacture of non-defense products appears imminent in view of the encouraging action being taken by representatives of business and State governments to arrange for a wider allocation of sub-contracts and a more liberal extension of OPM grants of basic metals and materials.

During the past week more than $2,750,000 in defense contracts for equipment of wide diversification which characterizes the manufacturing range of New England was awarded. Among many orders noted are electric lighting equipment, $2,586; transformers for Fort Adams, R. I., $2,640; pumping station construction at East Harttord, Conn., $128,721; wiring and lighting supplies for barracks in this area, include numerous installations from $1,500 up.

General Electric's new super-charger factory at Everett, Mass. will be air-conditioned by eighteen 60-hp. condensing units. Work on the $5,000,000 dirigible base at Weymouth, Mass., and the $3,500,000 extension to the Hingham Ammunition Depot will begin in about three weeks.

Worcester, Mass., defense contracts for 1941 will aggregate $100,000,000. Increases in mill wages in this area have been granted to more than 26,000 employees of Massachusetts and Rhode Island mills. A contract for electrical alterations on the Acushnet river drawbridge, New Bedford, Mass., has been awarded to Kenworth & Taylor, Inc., Everett, Mass., for $18,209. Keystone Manufacturing Co., South Boston, has bought a 35-kw. Fostoria infra-red oven. Hygrade-Sylvania Corp. held a well-attended central station conference on fluorescent lighting at Salem, September 8-9.

PACIFIC COAST

September shows signs of a decrease in the record pace which increased electrical wholesaler business over 50 percent throughout the West during the past quarter over last year. Requests for bids are fewer and smaller. Stocks are very high for building backlogs against possible non-delivery. But so far stocks of electrical staples, though spotty, are fairly adequate. A return of caution in purchasing and employing is evident.

General Electric submitted low bid of $647,885 for the 75,000-kva. generator for Shasta Dam. Allis-Chalmers was low bidder for Parker Dam substation transformers, their figure being $275,800; G.E. at $53,924 was low for the Gila circuit breakers; and Westinghouse at $50,450 for the Tucson transformers. Los Angeles has let contracts covering $403,300 for steel for its Harbor plant; $65,147 for Kelman and $30,750 for Westinghouse switchgear equipment; and $149,234 to Kelman for switching cubicles.

Industrial developments include a $2,000,000 addition to Vega Aircraft plant at Burbank; a $3,000,000 award total to Seattle and Everett firms for electrical steering gear for several 10,000-ton freighters; and preliminary work on the magnesium plant at Las Vegas, Nevada, to employ 4,000 men. The 146,000-kva. Pit River plant No. 5 of Pacific Gas & Electric Co., to cost $20,370,000 is now under way, together with its 9,000-kw. Yuba River project near Smartsville. Equipment has been ordered for its 75,000-kva., $6,850,000 steam plant near Midway, containing the largest individual generating unit on the P. G. & E. System. Besides these larger machinery orders, all Coast offices of manufacturers report steady orders for staple sizes of transformers, 5 to 50 horsepower motors, and fractional horsepower motors for pumping and pressure outfits and calculating machines.

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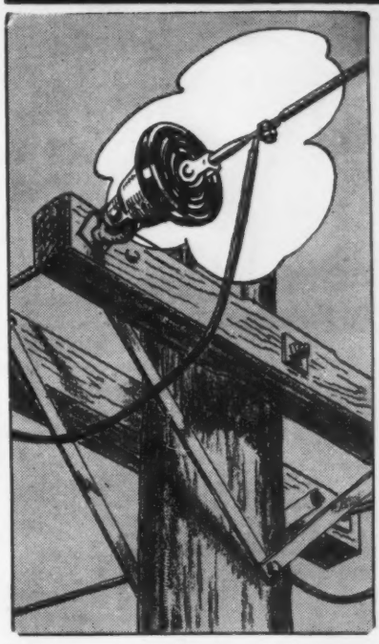

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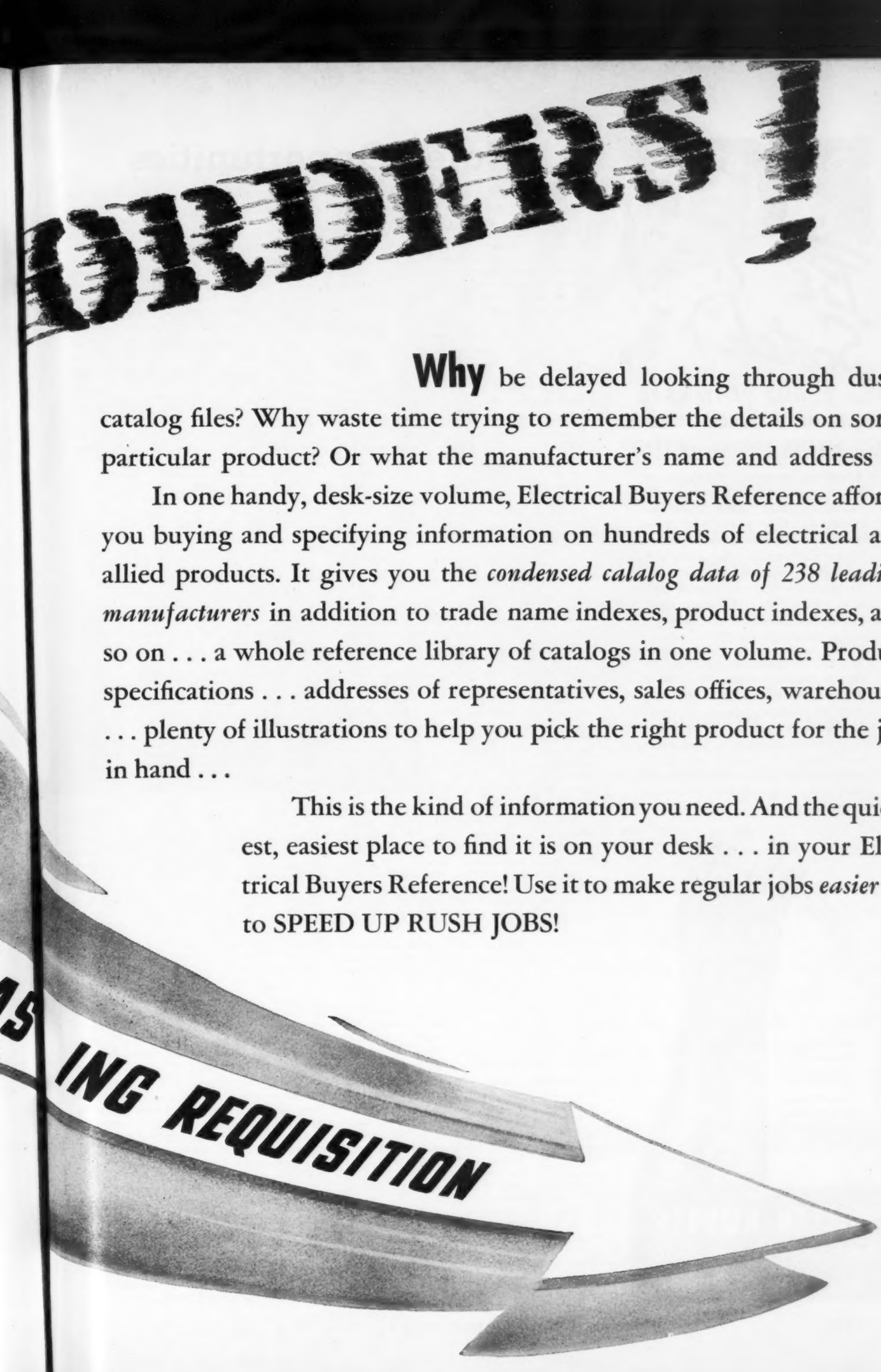

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SAULT STE. MARIE, MICH.—Edison Sault Electric Co. has approved plans for new steam-electric power plant, about 60x100 feet, in vicinity of Meridian Street and Gros Cap Avenue, with installation to include turbine-generator unit and accessories, three boilers and auxiliary equipment. Work is scheduled to begin at once. It is understood that station will be of temporary character at location noted for present emergency service, with equipment to be removed to another point in the future. Company also will make extensions in transmission lines for connection of new plant with main high-tension system. Day & Zimmermann, Inc., Packard Building, Philadelphia, Pa., is consulting engineer.

EAST SOUND, WASH.—Orcas Light & Power Co., East Sound, is arranging early call for bids for primary and secondary lines for extensions in rural electric system in part of San Juan County, including service facilities. Financing has been arranged through Federal aid. W. S. McCrea, Jr., Perkins Building, Tacoma, Wash., is consulting engineer.

FRANKLIN, VA.—Taggart Corp., 230 Park Avenue, New York, N. Y., manufacturer of paper bags and containers, plans installation of motors and controls, transformers and accessories, duct lines, switchgear, electric hoists, conveyors and other equipment in new mill at Franklin, where site has been selected, for production of heavy-duty paper bags for chemicals, building supplies and other materials. It will comprise several one and multi-story units, estimated to cost approximately $500,000. Chesapeake-Camp Corp., Franklin, manufacturer of kraft and other paper stocks, will furnish paper requirements for new converting plant, and will carry out large expansion in mill for such purpose, with installation of similar electrical equipment. Last noted extensions are estimated to cost about $700,000. Work on both projects is scheduled to begin soon.

NEWCASTLE, WYO.—Mountain States Power Co., Albany, Ore., has approved plans for addition to generating station at Newcastle, with installation of new generator unit and auxiliary equipment to double present capacity of 770 kva. Also will make extensions in transmission lines in that district, with additional power substation facilities.

SEATTLE, WASH.—Department of Lighting has plans maturing for extensions in several power substations, including units known as South, Magnolia and Columbia substations, with installation of additional transformers, switchgear and auxiliary equipment. Also will make additions in transmission lines for increase power supply different substations noted. Cost reported over $800,000.

NORFORK, ARK.—Arkansas Power & Light Co., Pine Bluff, has completed surveys and will begin work at once on proposed transmission line from power substation at Norfork to Forsyth, Mo., where connection will be made with high-tension system of Empire District Electric Co., Joplin, Mo., for interchange of service. As previously noted in these columns, this is part of expansion program of first noted company, to represent a total investment of about $10,000,000, including power station developments, transmission lines, power substations and other facilities. Work will be carried out over a period of months.

ROCKFORD, ILL.—W. F. & John Barnes Co., Inc., Rockford, manufacturer of boring, drilling, tapping and other machinery, plans installation of motors and controls, switchgear, duct lines, industrial lighting system, electric hoists, conveyors and other equipment in new plant on local site for production of machine tools for Government. Cost estimated close to $2,000,000. Fund in that amount will be secured through Defense Plant Corporation, Washington, D. C., a Federal agency, for project.

SAULT STE. MARIE, MICH.—Chief of Engineers, United States Army, Washington, D. C., plans new hydroelectric power plant north of locks at St. Marys Falls, near Sault Ste. Marie, to replace present old generating station at that point. Project will include new power dam, hydroelectric station with initial capacity of 14,000-kw., transmission lines, switching station, power substation and auxiliary structures, with cost estimated at $3,500,000. War Department has submitted recommendation to Congress for appropriation in that amount for project and work will begin as soon as this has been authorized. At a later date it is proposed to carry out further development at same place, with larger hydroelectric station, entire project estimated to cost $6,500,000 in addition to sum noted.

BLUFFTON, OHIO—Central Ohio Light & Power Co., Findlay, Ohio, has begun expansion at Woodcock steam-electric generating station at Bluffton, to include installation of new 7,500-kw. turbine-generating unit, boiler and auxiliary equipment. Company also will make extensions in switchyard and transmission lines.

UXBRIDGE, MASS.—New England Power Co., Boston, has made agreement with Government for relocation of certain transmission lines in company territory, necessary for a Federal project, at a cost estimated at $35,503, to be furnished by Government, and will carry out work at once.

BURBANK, CALIF.—Vega Airplane Co., 2555 North Hollywood Way, manufacturer of aircraft and parts, plans installation of motors and controls, regulators, switchgear, fluorescent lighting system, duct lines, electric hoists, conveyors and other equipment in new plant on local site for production of airplanes for Government. It will consist of several units, estimated to cost $1,822,700. Fund in that amount will be furnished by Defense Plant Corporation, Washington, D. C., a Federal agency, for project. Work is scheduled to be placed under way soon.

ST. LOUIS, MO.—Union Electric Co. has approved plans for new power substation at 3316 North Nineteenth Street, and will carry out work this fall. Also will make extensions in transmission lines for connection with new station, which will be used for distribution service in district noted.

PORTSMOUTH, VA.—Water Department plans installation of two electric generator sets, gasoline engine-driven, in waterworks pumping station, where expansion and improvements will be made. Also will install two large motor-driven pumping units and auxiliary equipment. Entire project will cost about $500,000. Fund in that amount will be financed through Federal aid.

DENISON, TEX.—United States Engineer Office, Denison, receives bids until September 30 for two 56,000-hp. hydraulic turbines, with governors and accessories for installation in Denison dam hydroelectric power station. Contracts for electric generators will be placed separately.

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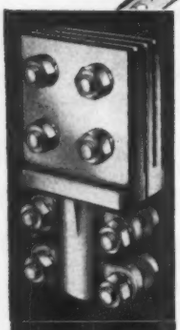

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New REA Allotments Total $1,195,000

Announcement has been made of allotments by the Rural Electrification Administration, totaling $1,195,000 to eighteen borrowers in fourteen states. REA's loans since it was created in 1935 now total $388,827,121. Among the recent allotments are the following:

ALABAMA—Baldwin County Electric Membership Corp., Robertsdale, L. A. Killough, Jr., supt., $30,000 to complete the system.

COLORADO—Intermountain Rural Electric Assn., Bailey, J. R. Maile, supt., $39,000 to build 24.3 miles of line, 185 members in Jefferson County.

GEORGIA—Grady County Electric Membership Corp., Cairo, N. W. Stanfill, supt., $67,000 to build 80 miles of line, 244 members in Grady, Thomas, Decatur, Colquitt and Mitchell counties.

IOWA—Humboldt County Rural Electric Cooperative, Humboldt, Howard L. McKee, supt., $99,000 to build 95 miles of line, 195 members in Humboldt and Kossuth counties.

KANSAS—Arkansas Valley Electric Cooperative Assn., Inc., Sterling, Alvia B. Davis, supt., $60,000 to build 94.6 miles of line, 163 members in Rice, Ellsworth, Reno, Kingman, Stafford and McPherson counties.

LOUISIANA—Valley Electric Membership Corp., Natchitoches, L. H. Huson, asst. supt., $36,000 to build 36 miles of line, 178 members in Winn Parish.

MICHIGAN—Fruit Belt Electric Cooperative, Cassopolis, Robert Thompson, manager, $125,000 for additional generating facilities.

MISSISSIPPI—Four-County Electric Power Assn., Columbus, Louis Wise, supt., $35,000 to build 70 miles of line, 282 members in Choctaw County.

OKLAHOMA—Northeast Oklahoma Electric Cooperative, Inc., Vinita, William C. Atkinson, supt., $218,000 to build 207 miles of line, 543 members in Delaware, Ottawa, Rogers, Craig and Mayes counties.

OREGON—Umatilla Electric Cooperative Assn., Hermiston, Ray L. Woolley, supt., $15,000 to complete a section of the system.

SOUTH CAROLINA—Little River Electric Cooperative, Inc., Abbeville, F. Willard Brown, supt., $60,000 to complete the system.

TENNESSEE—Holston Electric Cooperative, Rogersville, Winfield B. Hale, attorney, $12,000 to complete the system.

TEXAS—Floyd County Rural Electric Cooperative, Inc., Floydada, L. W. Chapman, supt., $152,000 to build 216 miles, 389 members in Crosby, Dickens, Floyd and Hale counties.

WISCONSIN—Vernon Electric Cooperative, Westby, N. F. Leifer, supt., $65,000 to build 71 miles of line, 181 members in Vernon, Monroe, Sauk, Juneau and LaCrosse counties.

Among the construction contracts approved between July 30 and August 16 were the following:

ALABAMA—Sand Mountain Electric Membership Corp., Fort Payne, M. C. Stewart, supt., and Gordon Persons & Co., Inc., Montgomery, Ala., engineer, contract to Smith Construction Co., Nashville, Tenn., 101 miles of line, 494 members; bid, $107,527.

LOUISIANA—Concordia Electric Cooperative, Inc., Ferriday, H. B. Gieb, Dallas,

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Tex., engineer, contract to Stuart C. Irby Co., Jackson, Miss., 144 miles of line, 231 members; bid, $85,719.

MAINE—Union River Electric Cooperative, Inc., Aurora, Harry S. Allen, supt., and J. R. Worcester & Co., Boston, Mass., engineer, contract to the Dole Co., Bangor, Me., 81 miles of line, 300 members; bid, $72,200.

MICHIGAN—Cloverland Electric Cooperative, Sault Sainte Marie, Harvey E. Kappahahn, mgr., and J. & G. Daverman Co., engineer, Grand Rapids, Mich., contract to Honold & LaPage, Inc., Sheboygan, Mich., 142.6 miles of line, 422 members; bid, $107,777.

MINNESOTA—Renville-Sibley Cooperative Power Assn., Fairfax, Ewald Schmechel, acting supt., and Ellerbe & Co., St. Paul, Minn., engineer, contract to Acme Construction Co., St. Paul, Minn., 74.5 miles of line, 164 members; bid, $50,305.

MISSOURI—Platte-Clay Electric Cooperative, Inc., Platte City, Howard Alexander, acting supt., and E. T. Archer & Co., Kansas City, Mo., engineer, contract to Elkhorn Construction Co., Norfolk, Neb., 66.04 miles of line, 128 members; bid, $45,463.

NORTH CAROLINA — Pamlico - Beaufort Electric Membership Corp., Grantsboro, H. M. Harris, supt., and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to Mill and Marine Electric, Inc., Gastonia, N. C., 139.80 miles of line, 351 members; bid, $106,063.

NORTH DAKOTA—R. S. R. Electric Cooperative, Inc., Milnor, Banister Engineering Co., St. Paul, Minn., engineer, contract to Carl Swedberg, Wheaton, Minn., 178.5 miles of line, 296 members; bid, $113,804.

OHIO—Paulding-Putnam Electric Cooperative, Inc., Paulding, Herbert K. Monroe, supt., and Putnam and Woolpert, Dayton, O., engineer, contract to Miami Construction Co., Dayton, O., 51 miles of line, 124 members; bid, $34,932. South Central Rural Electric Cooperative, Inc., Lancaster, Darwin Kindler, mgr., and Gibbs & Hill, Inc., Harrisburg, Pa., engineer, contract to W. R. Cutnaw Co., Columbus, O., 57.65 miles of line, 215 members; bid, $43,295.

OREGON—Benton-Lincoln Electric Cooperative, Inc., Corvallis, Guy Thomas, supt., and John W. Cunningham and Associates, Portland, Ore., engineer, contract to Max J. Kuney Co., Spokane, Wash., 203.4 miles of line, 403 members; bid, $199,909.

TENNESSEE—Mountain Electric Cooperative, Mountain City, B. O. Vannort, Charlotte, N. C., engineer, contract to Miller-Baxter Co., Inc., Indianapolis, Indiana, 120 miles of line, 480 members; bid, $106,843.

TEXAS—Mid-South Cooperative, Inc., Navosota, Ripley S. Greenhaw, supt., and Beavers and Lodal, San Antonio, Tex., engineer, contract to Taylor Construction Co., Taylor, Tex., 136 miles of line, 238 members; bid, $76,985.

VERMONT—Vermont Electric Cooperative, Inc., Eden Mills, Harry D. Bowman, supt., and Walter N. Cook, Newport, Vt., engineer, contract to Donovan Contracting Co., St. Paul, Minn., 50 miles of line, 101 members; bid, $38,537.

WISCONSIN—Richland Co-operative Electric Assn., Richland Center, Herbert H. Stofen, supt., and Wisconsin Development Authority, Tenney Building, Madison, Wis., engineer, contract to M. F. Hodge & Sons, Medford, Wis., 25 miles of line, 58 members; bid, $17,257.

WYOMING—Bridger Valley Electric Assn., Inc., Mountain View, George W. Cordray, supt., and H. S. Nixon, 219 Omaha Grain Exchange Bldg., Omaha, Neb., engineer, contract to National Construction Co., P.O. Box 1392, Rapid City, S. D., 42.8 miles of line, 74 members; bid, $28,372.

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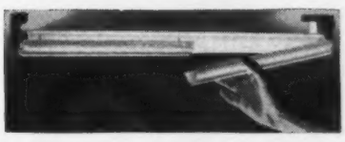

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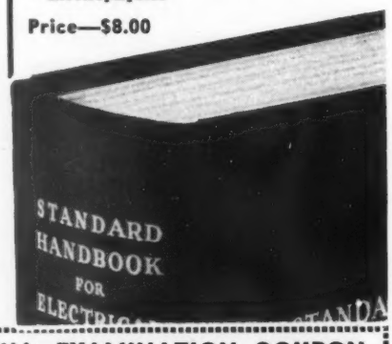

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LETTERS TO THE EDITOR

"Electric and Electrical"

To the Editor of ELECTRICAL WORLD:

I have read, with much interest, your article on "Electric and Electrical" in the August 23 issue and I immediately got a nice sharp razor blade and proceeded to "split hairs." We certainly refer to electrical engineers, but I have never heard one of that brotherhood called an electric engineer. There is apparently some distinction between the words in this usage, and in an endeavor to run it to earth I referred to the Annandale Dictionary, where I found that the two words were not differentiated at all, but there is a figurative meaning, "full of fire, spirit or passion and capable of communicating it to others."

It seems that in general usage, in this country at least, the word "electric" is used in the figurative sense rather than the word "electrical." Where there is a possibility that an expression might be read both figuratively and literally, it seems that the word "electrical" is used for the literal meaning. For example, an electrical stenographer would be one who is employed in an electrical industry and an electric stenographer would be one who is full of fire, spirit or passion and capable of communicating it to others.

I trust your razor is sharp enough to find this distinction.

JOHN R. DUNBAR,
Canadian Westinghouse Co., Ltd.
Hamilton, Canada.

[There are so few matters these days on which it is possible to remain neutral that the least opportunity to do so should be cherished. Therefore our only comment on Mr. Dunbar's comment is to reiterate the stand stated in the editorial to which he refers—EDITOR.]

To the Editor of ELECTRICAL WORLD:

Referring to the editorial entitled "Electric and Electrical," appearing on page 68 of the August 23 issue of ELECTRICAL WORLD, I would inform you that a new American Standard containing distinctive definitions of these terms will soon be available to the public.

This American Standard for Definitions of Electrical Terms, which has been in preparation for more than twelve years by a sectional committee of the American Standards Association, sponsored by the American Institute of

Electrical Engineers, defines these terms as follows:

Electric means containing, producing, arising from, actuated by, or carrying electricity or designed for and capable of so doing.

Examples—Electric eel, energy, motor, vehicle, circuit.

Electrical means related to, pertaining to, or associated with, electricity, but not having its properties or characteristics.

Examples—Electrical engineer, handbook, insulator, rating, school, unit.

NOTE—Some dictionaries indicate these terms as synonymous, but usage in the electrical engineering field has in general been restricted to the meanings given in the definitions. It is recognized that there are border line cases wherein the usage determines the selection.

C. H. SANDERSON,
Chairman Sectional Committee
on Electrical Definitions
American Standards Association

•

Defense Operations Speeded Through Sales

To the Editor of ELECTRICAL WORLD:

There is one misprint in my article "Defense Operations Speeded Through Power Sales" (ELECTRICAL WORLD, July 16, 1941) which should be corrected in a note in an early issue. In my original copy I say: "Recent installation of electric furnaces *for annealing brass valve stems completely eliminated breakage in service. The same operation performed in the old fuel-fired furnaces* showed a loss of 10 percent by breakage.

As printed on page 51, the italicized words were omitted, completely changing the sense of the statement.

Captions under the photographs are also reversed, but this is not so serious, as the error is obvious.

EDMUND F. BURKE,
Cleveland, Ohio.

[We regret this error, which occurred in recopying the story and was not noted on the galleys and the printed page.—EDITORS.]

•

Commercial Cooking in Philadelphia

To the Editor of ELECTRICAL WORLD:

I wish to call your attention to a typographical error which occurred in a story appearing in your August 23 issue relative to the commercial cooking activities of the Philadelphia Electric Company.

In the headline the figure 13 kw. is used, when the correct figure is 1,300 kw. In addition, the headline gives the

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Its Outstanding Features

- *lower groove has ample insulation for 6600* volts.
- *on corner turns, wire can be dropped into lower groove . . . increasing strength of pin and reducing possibility of both pin-bending and pin-breakage.*
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impression that this figure refers to all commercial campaigns, whereas actually it refers only to commercial cooking. While the first paragraph of the story clarifies the situation, it is to be regretted that the headline was misleading.

In the course of a normal year we sell more than 1,300 kw. of commercial cooking load. As a matter of fact, our cooking sales in 1940 total 3,867 kw. In addition, we have campaigns on such other applications as lighting, heating, ventilation, air conditioning and refrigeration.

P. M. ALDEN, Manager Retail Sales
Philadelphia Electric Company,
Philadelphia, Pa.

•

Census of Strategic Metal Inventories

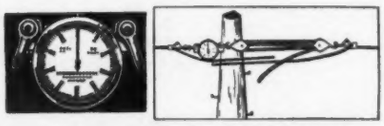
"Amazing" disappearance of supplies of many strategic metals is at least one moving factor in OPM's arrangement with the Bureau of Census for a tabulation of manufacturers on their inventories and uses of the non-ferrous metals. More than 65,000 manufacturing firms will get the questionnaires, asking them to report quantities on hand and the uses made during August of antimony, cadmium, cobalt, copper, ferro-alloys, iridium, lead, manganese or spiegeleisen, mercury, molybdenum, non-ferrous alloys, tin, vanadium, tungsten, zinc and scrap containing any of these.

OPM has seen estimate after estimate on these metals go haywire, with consumption zooming far beyond indicated levels. Copper is a case in point—apparent consumption continues to outpace rising supplies until defense officials have become fearful that all non-defense uses will have to be shut off. The census idea was conceived as a means of finding out what is being done with it all.

•

Sign Bonneville Contract

West Douglas Electric Co-operative, Inc., Douglas County, Ore., has executed a twenty-year contract for the purchase of 125 kw. of Columbia River electricity from the Bonneville Power Administration. Delivery of power started September 2. The new contract permits the co-operative to purchase electricity at wholesale at the power administration's optional prime power rate of one-quarter of a cent per kilowatt-hour of monthly use, plus 75 cents per kilowatt of monthly demand. The West Douglas system is the eleventh electric co-operative to execute a contract with Administrator Raver.



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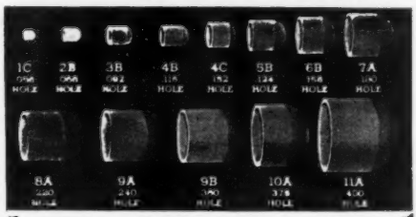

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Mercury Vapor Lamps Light Turnpike Tunnels

[*Continued from page 59*]

in one or two installations the sodium-vapor lamp has been used. The lighting units are installed in the tunnel ceiling slab, 14 ft. 4 in. above the roadway and staggered over each of the two oppositely directed traffic lanes, instead of in the upper part of the side walls, as has been customary in the past. They are spaced 37 ft. apart, measured along the center line of the roadway, giving a spacing to mounting-height ratio slightly in excess of 2.5 to 1. Near the portals the spacing is gradually reduced to 11½ ft. to give a graduated increase in lighting intensity with the maximum intensity at the tunnel entrance. The luminaire is of the so-called "open type"; that is, no glass cover is interposed, as in typical past practice, between the reflector and the tunnel interior. Incidentally, the tunnels are finished in natural concrete, left unpainted because of the lighting system design.

Scheduled Cleaning

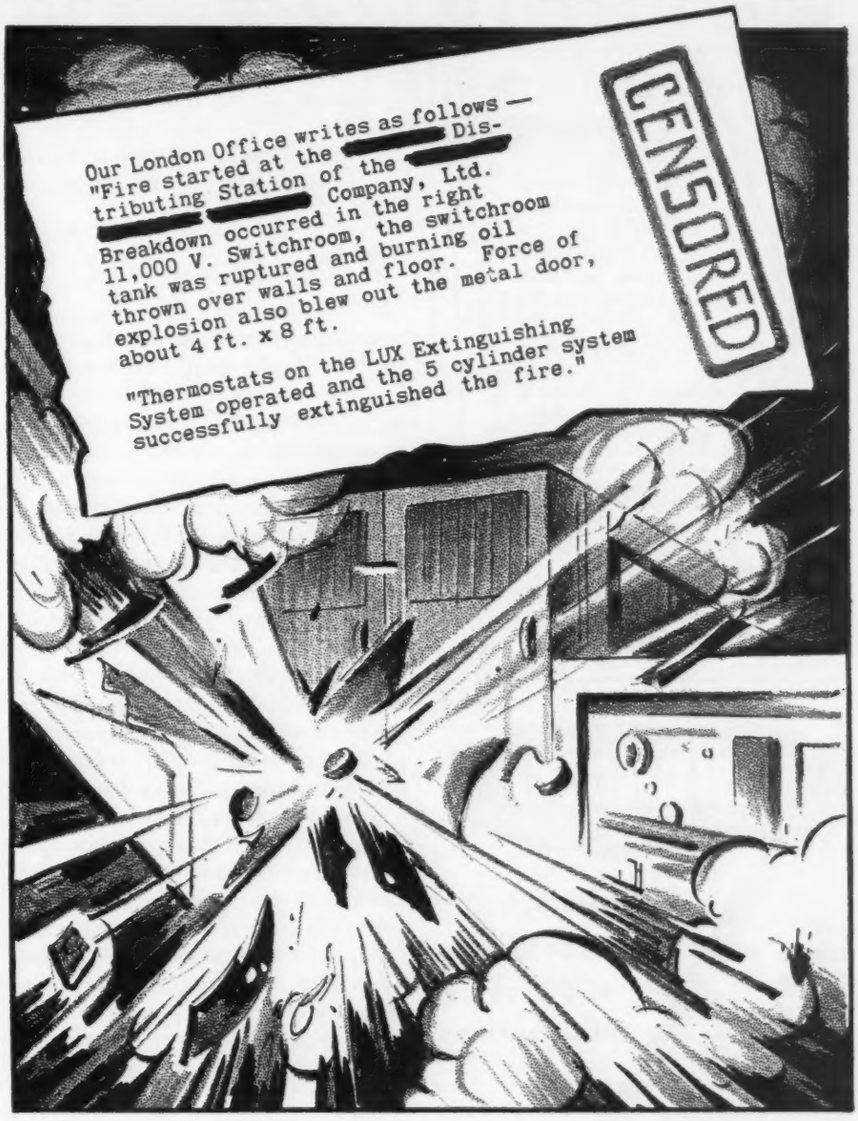
Optical parts of the luminaire are designed to provide easy and quick removal from the housing, so that cleaning may be done at the tunnel portal where facilities are provided, rather than at the point of installation. The cleaning schedule calls for immediate substitution of spare optical parts for the removed soiled ones, so that service is interrupted for only a few seconds.

At tunnel portals, which are bell-mouthed for the admission of daylight to supplement tunnel lighting, the artificial illumination level is stepped up from its normal 6 ft.-candle value to a maximum of 30. This allows the eye time to adjust itself to changed lighting conditions and to overcome the temporary blindness often experienced when passing from daylight to tunnel light, and vice versa.

The tunnel luminaire is mounted in a housing built into the ceiling slab during construction. It consists of a specular stippled Alzak reflector curved to spread the light up and down the tunnel with an absolute cut-off at 62 deg. A mogul multiple socket is rigidly held in position at the side of the reflector locating the lamp in a horizontal position normal to the tunnel and completely shielded from the eye of the observer. The optical parts

DID A SABOTEUR START THIS FIRE?

...A REPORT FROM ENGLAND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are attached to the luminaire housing by bayonet catches, and for convenience of removal from the housing the socket lead wires are provided with a plug terminal to fit a receptacle in the housing.

Many factors governed the selection of materials and of luminaire design, such as dampness in the tunnels, deleterious atmospheric conditions near the ceiling which might lead to corrosion of the reflector surface, moisture in the luminaire housing which might injure the lead wires and the intense heat in the luminaire itself.

Use Luminaire Heat

Luminaire heat was advantageously used in its design. The temperature in the inverted reflector, although high, was found to be lower than that at which the Alzak aluminum finish on the reflector surface "crackles." Under continuous burning, a pocket of heated air is formed within the reflector which, so long as the lamp is kept burning, keeps the surface of the reflector dry and prevents deposit on the reflector surface of damp and dirty moisture. If, however, there is an outage and the cold reflector remains unserviced for a considerable period, moisture and dirt will collect on the reflector and may even set up a chemical action which might result in "pitting." For this reason a rigid maintenance schedule has been set up. Even with the so-called "inclosed" units, "breathing" is likely to occur and permit infiltration of deleterious fumes, thus defeating purpose of the inclosure.

The lead wires for the luminaire, especially made for this application, are self-drying, in that, when subjected to moisture, leakage currents cause the flexible cable to dry out, even after extreme water saturation.

Some tunnel engineers have objected to the location of luminaires in the ceiling slab or tunnel roof because of possible interference with ventilation, but the effectiveness of this location cannot be questioned. Because of the design of the luminaires and their location in the ceiling slabs, the utilization efficiency is high and glare is reduced to a minimum. Object discernment by surface detail is possible at distances up to 1,000 ft.; discernment by silhouette vision up to 2,000 ft.

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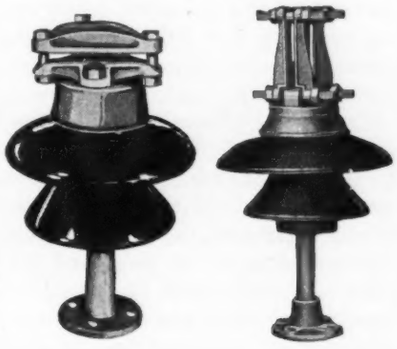

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36 pages giving types, voltages, ratings, and dimensions in inches.

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MELROSE PARK, ILL.

of the vehicle ahead renders certain types of contrasts clearly visible and permits distance to be judged more readily than under lighting of the past. Neither in daylight nor in darkness does the driver entering or leaving a tunnel experience temporary blindness due to changes in light intensity.

Regulator and Capacitors Relieve Feeder Voltages

[*Continued from page 56*]

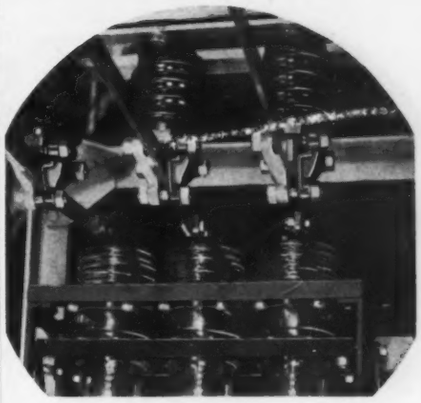
assumption that each 1 percent increase in average feeder voltage increases the revenue 1.5 percent, it was estimated that the addition of the regulators would result in about 4 percent increase in feeder revenue. With an annual energy consumption of 1,600,000 kw.-hr., and using a figure of 3 cents per kw.-hr. for energy sold, the regulators would be responsible for an annual gain in revenue of about $1,900.

Combining the cost of the capacitors and regulators, there is a total investment of about $2,900, against which is balanced an estimated annual return of $2,222 through the use of this equipment. This means that not only would the operating conditions of the feeder be vastly improved, but the return would be about 76 percent on the investment. The results as estimated approximated the conditions obtaining after the installation of the equipment. Complete detailed measurements of load conditions were not made throughout the entire length of the feeder, but the values estimated proved sufficiently close to the results to justify the approximations made in this case.

•

Set National Conference on Photo Lighting

A national photographic lighting conference for amateurs, professionals, photographic dealers and manufacturers, to present newest knowledge of artificial light as applied to photography, will be held October 6-10 in New York and Bloomfield, N. J., under the sponsorship of the Westinghouse lamp division. Only one session will be held in New York at the Electric and Gas Association auditorium. This will be the first meeting, the evening of October 6. For all other sessions the Westinghouse Bloomfield auditorium will be used.



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INDOOR BUS
SUPPORTS AND
FITTINGS

for carrying any type of bus any way . . .

The "THREE E" complete line of Bus Supports up to and including 23000 volts are made for carrying horizontal or vertical bars and round conductors. "THREE E" engineers have been responsible for much of the pioneering and development of bus supports and have always made advanced design available—plus this, is strong construction. Fittings are made to meet every requirement.

"THREE E" Form E
Indoor Insulating
Supports

This line is recommended for heavy duty service in power houses and substations where high electrical safety is required and where the mechanical stresses, due to short circuits, etc., may run high. The parts are interchangeable. Write for Bulletin No. 125.

Bulletin 226 will give you complete data on moderate duty indoor bus supports and fittings—be sure to request a copy.

Electrical
ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILL.

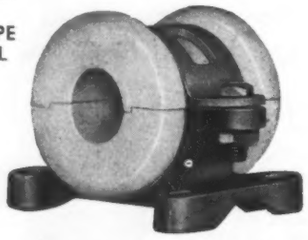
Practical
ECONOMICAL METHOD OF RIGIDLY SUPPORTING CABLES

Extremely flexible and can be turned in any direction with respect to its mounting.

"THREE E"
Type CIL
CLAMP INSULATOR SUPPORTS

Made in flat or pipe mounting types. Single hole mounting is particularly advantageous where supports are to be mounted on concrete or similar surface. Flat mounting supports can easily be converted to pipe mounting. Metal parts as well as porcelain parts are interchangeable. Outside dimensions of small or large size porcelain spools are the same—hole sizes only change—this permits future increase in cable diameter by simple replacing of insulator spools with larger holes.

TYPE MIL



This type is intended for heavy duty service in power houses, substations, industrial plants, mills, mines, etc. Bases are of heavy malleable iron casting for 4-bolt flat mounting or 2 U-bolt pipe mounting. Metal and porcelain parts are interchangeable. Both MIL and CIL supports can be used with properly insulated cable of any voltage or with bare cable up to 600 volts. Write for Bulletin No. 200.

THREE E

Electrical
ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILL.

Floating Plant Serves Base Load

[*Continued from page 66*]

produced 564,000,000 kw.-hr. in its decade of service near Portsmouth, the corresponding total output of the company's stations including purchased power being approximately 2,361,000,000 kw.-hr., of which fuel-burning plants produced about 639,000,000 kw.-hr. Typical plant economy at the *Jacona* is represented by 14,500 B.t.u. per gross kilowatt-hour in October, 1940 (output 13,500,000 kw.-hr.); 14,700 B.t.u. in September, 1940 (9,700,000 kw.-hr.), and 14,600 B.t.u. in July, 1940 (10,000,000 kw.-hr.). The average B.t.u. for the entire year 1940 was 15,000 and for 1939, 15,150. The B.t.u. per kilowatt-hour ranges from 19,400 at 10 percent monthly load factor to 14,500 at about 60 percent, as illustrated. In periods when the *Jacona* is operated at substantially full rating the load curve is virtually a straight line for 24 hours. Normally the plant is run from Mondays to Fridays inclusive on base load, except as indicated above when hydro conditions permit reduction of steam generation on the system.

Relation Between *Jacona* and System Outputs

	Millions of Kilowatt-Hours		
	System Production Including Purchased Energy	System Fuel Plant Production	*Jacona* Production
1931	188	67	48#
1932	187	38	38
1933	191	49	49
1934	210	56	56
1935	223	52	51
1936	218	73	70
1937	247	49	46
1938	262	23	23
1939	308	102	79
1940	327	130	104
	2,361	639	564

May 6 to Dec. 31.

Maintenance Experience

Annual inspection of the hull by a diver is scheduled and the *Jacona* has been drydocked at Portsmouth twice since going into service in that locality. This was done in 1934 and 1939, the ship being towed to the Portsmouth Navy Yard and kept in the dock about five days in each case. She was away from her moorings about ten days and out of service for this purpose about three weeks, in each of these years. Three tugs were utilized in the towing job, as the river has a tide of about 6 knots at this point, and the clearance at the old drawbridge was a few feet at most. She went down the river on slack water and returned at a corresponding stage of the tide. As the distance is about 1.5 miles to the drydock, the total cost of docking is relatively low, as insurance rates and time lost from service would be much higher if the ship had to be towed to Boston or to some other distant point via the high seas.

The hull has been cleared of mussels and seaweed in large quantities during drydocking, and painted after scraping. No barnacles were found on the bottom. A few rivets had to be replaced and a little patching of plates done.

Experience has shown that dry docking need not be on a rigid schedule, but can be arranged for at times most convenient for the system, at intervals of four to six years.

When system conditions permit, it is planned to overhaul the boilers semi-annually, and without fail once a year. A few tube replacements have been necessary and the furnaces rebuilt. Both condensers were retubed with "Yorcalbro" aluminum bronze in 1935, in place of the original Admiralty tubing. Generator rotors were removed in 1934 for inspection and cleaning, these being handled in limited space by block and falls. The last stage wheel of one turbine was rebucketed in place by the manufacturer in 1935 and the last stage wheel of the other was rebucketed in 1939. A complete overhaul of one unit has recently been accomplished and the second unit will be overhauled as soon as system conditions permit.

In general the operating problems of the plant have been similar to those of a shore station of comparable equipment and have not been increased by the installation's being afloat. A few emergencies have been met with. In one case a farmer accidentally shut a land valve on the city water feed line supplying make-up and water to the turbine bearing seals. While there was plenty of water in the surge tank for make-up, it was found that there was not sufficient reserve for the seals. This condition was remedied by storing water in an 8,000-gal. drinking water tank on shipboard, so that now the city water line can be shut off for a number of hours without interfering with the plant's operation.

The operating force comprises 31 men, including a chief engineer and assistant chief holding marine engineers' licenses not required by law. The assistant chief is in direct charge of mechanical maintenance, and in addition an electrical maintenance man is a member of the staff. A typical eight-hour shift calls for a shift engineer (marine), one water tender, one fireman and assistant fireman, two turbine operators, one pump man and a switchboard operator. There are also a laborer, a machinist, two watchmen and an oil man on the staff. The operating force does not reside on the ship.

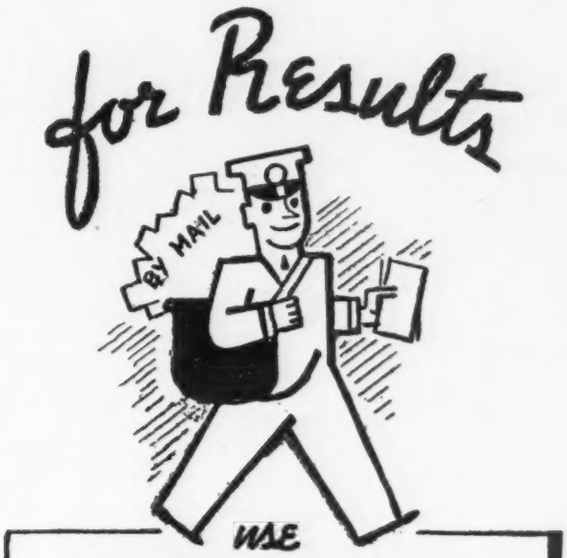
Salvaged Meter Parts Given Chemical Cleaning

[*Continued from page 71*]

faces and frames of brass registers which have been blackened by fire immersion in the alkali tank for approximately fifteen mintues is recommended, then rinsed in running cold water and blown off thoroughly. After this registers are given the routine brightening bath. Aluminum registers should *never* be immersed in an alkaline bath. Brightening treatment in most cases will remove all traces of fire or discoloration. Brass frame registers require ten minutes in the cleaning solution, five minutes for each water rinse and five minutes for the last bath. Aluminum frame registers usually require from three to eight minutes in the brightening bath. If they remain longer they may become dark.

For brightening registers immersion in brightening solution, followed by rinses in cold and hot water and a final bath in tetrachlorethylene or alcohol, is best. Frequent agitation aids the reaction greatly. A thorough blowing off with compressed air following the water rinses and the final bath is desirable. They should be heated until dry.

Two important factors should be kept in mind while cleaning registers: (1) Cleaning solution should be entirely removed in the rinses and in the blowing-off operations; (2) nothing but the solution should be allowed to contact the dial faces if the numerals and letters are to remain unblemished when dry. In some cases the protective coating is removed from the dial face in cleaning, thus exposing the numerals to smearing when handled. Registers with this



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type of dial should be given a spray treatment with clear lacquer after drying.

Cleaning brass registers that have been removed from steam condensation meters follows the same treatment outlined for watt-hour meter registers. Usually they require more time in the alkaline and brightening solutions than other types of registers.

Before cleaning jewel assemblies all jewel parts are heated 30 minutes in an electric oven at a temperature of 180 deg. F. This makes dirty oil less viscous and prepares the surface for degreasing treatment. Assemblies are next put in a bath of tetrachlorethylene, which removes all oil mass. Oil removal is important, particularly in oil-tight bearings where the oil is held in a deep well.* After drying, work is ready for the final cleaning bath. Jewel screws and caps are immersed in a brightening solution and agitated ten minutes, rinsed in cold, then hot water and allowed to dry. Material is placed in a final rinse bath of tetrachlorethylene heated at 100 deg. F. for two hours to dispel any stray solvent present under the jewel.

Voltage Regulation on REA Rural Circuits

[*Continued from page 62*]

power factor, 7,200 volts, line-to-ground. Single phase spacing, 4 feet; 3-phase equivalent spacing 4.69 feet.

Conductor Size, Copper Equivalent	Wire Factor Single Phase	Three Phase
0		0.613
1		0.715
2	3.55	0.838
4	4.83	1.20
6	6.70	1.76
8	9.54	2.66
9½	12.33	
11	17.23	

For other voltages the wire factor varies inversely as the square of the voltage.

$$\text{Percent drop} = \frac{KW \text{ (miles)}}{1{,}000} \times \text{(wire factor)}$$

In case of a difference in impedances for various makes of conductors of the same general conductivity size the highest impedance values were used.

* G.M.R. will also vary slightly with current density.

•

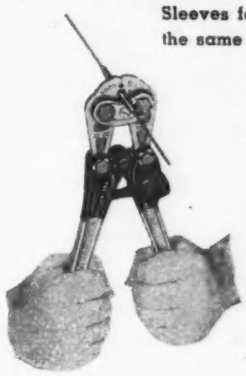
Energy Sales Set Record

Gross sales of electric energy by the municipal plant at Martinsville, Va., for July totaled $26,031, a new high.

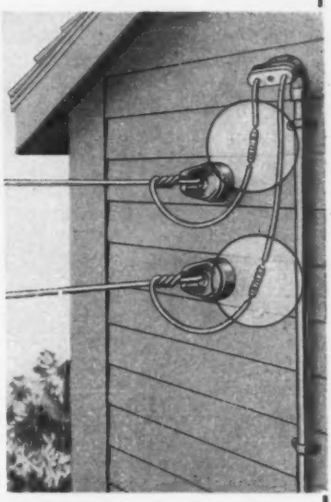
SIMPLIFY House Service Connection Jobs with Nicopress SLEEVES

The easiest, simplest and most economical method of making your House Service Connections is with Nicopress Sleeves and Tools.

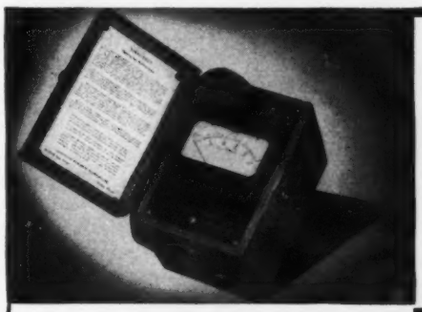
With these compression splicing sleeves the joints formed are neat in appearance and may be easily taped—the connections are positive—splices are tight and strong. The Nicopress Sleeves for this type of work are the same as the standard sleeves used for line splicing except that they are shorter. Sleeves can also be supplied in Reducing sizes.



Try "Nicopress" on your next House Service Connection jobs and note what time and trouble savers they are. Order from your jobber today.



THE NATIONAL TELEPHONE SUPPLY COMPANY
5100 Superior Avenue, Cleveland, Ohio
Canadian Mfr.—N. Slater Co., Ltd., Hamilton, Ont.
Export Distributor—International Standard Electric Corp., New York, N. Y.



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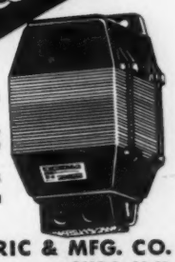

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Utilities Increase Rural Service

Electric service in rural Wisconsin was used by 9,485 more farm customers last year than in 1939, according to a survey recently completed by the Wisconsin Department of Agriculture.

The survey, conducted by the department's rural electrification division in co-operation with the Public Service Commission, showed that 84,155 farm customers were being served with electricity in Wisconsin at the close of 1940, compared with 74,670 for the preceding year.

Private utilities showed an increase of 4,210 farm customers in 1940, municipal utilities a gain of 357 and co-operatives a gain of 4,918, according to Robert A. Merrill, chief of the rural electrification division.

For the entire year a total of 123,678,457 kw.-hr. was sold to all rural customers, including non-farm customers served from farm lines, at a total cost of $5,882,835. The average cost to these customers was 4.7 cents per kilowatt-hour, compared with 4.74 cents in 1939.

•

Will Build Addition

Hertner Electric Co., Cleveland, Ohio, will begin work at once on a new one-story addition, about 60 x 240 ft., with adjoining smaller structure, 30 x 60 ft., to be used for expansion in production department. Cost is reported at more than $100,000, with equipment. Contract for erection has been let to E. J. Benes & Co., Terminal Tower Bldg., Cleveland.

•

Issues New House Organ

Hygrade Sylvania Corp. launched this month the first issue of "Hygrade Lighting News," a new house organ for the electrical trade. The new publication is an attractive eight-page, two-color, 8½ x 11 folder, consisting of four pages of news and promotional items and four pages of technical material of an informational nature. The theme of the publication will be "what's new in lighting," and it will contain news and technical data on both fluorescent and incandescent lighting.

•

Grand Coulee Elevators

Installation of two of Grand Coulee Dam's six high-speed elevators, some of which will take passengers on a 30 to 35-story ride from the crest of the 550-ft. high structure deep into the heart of the concrete mass, is under way in the twenty-story west power house. Next fall or winter the Otis Elevator Co. of San Francisco, operating under a $187,352 contract, will install two units in the dam proper—a passenger elevator and a combination passenger-freight elevator. Later, when the need arises, two other similar machines will be provided.

•

OPM Copper-Zinc Group

Appointment of a Copper and Zinc Defense Industry Advisory Committee has recently been announced by the OPM bureau of clearance of defense industry advisory committees. The committee is composed of 35 men representing the five principal divisions of the industry—copper producers, zinc producers, brass and copper sheet rolling and tube forming industry, copper wire and cable manufacturers, and zinc fabricators.

•

Adopt New Official Name

The official name of the Utility Electric Company, manufacturer of Toastswell toasters and other heating appliances, has been changed to the Toastswell Company. The company's headquarters are located in St. Louis, Mo.

•

Brazilian Capacity Gained 14% in 1940

Total installed capacity in Brazil was 1,186,882 kw. in 1940, as compared with 1,044,738 kw. in 1939, a gain of 13.6 percent, according to the *Brazil Trade Journal*. Hydro-electric capacity accounted for 993,742 kw. of the 1940 total, as compared with 884,570 kw. in 1939.

In 1940 there were 1,312 enterprises supplying electricity to 2,331 localities, a gain of 136 in number of firms over 1939. These enterprises operated 740 steam plants in 1940, as compared with 637 in 1939, and 732 hydro plants, as compared with 738 in 1939. Twenty-seven plants in 1940 had mixed generating equipment, while there were 64 that had hydro-electric equipment for private use.

The report points out that the total hydraulic installed capacity in 1940 represented only 7 percent of the total hydraulic potential of the country. "The apparent reluctance to develop the possibilities which exist in the country," it continues, "may be partially explained by the fact that there are few but extremely high potentials available in the regions which are inaccessible and remote from the industrial or urban centers."

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INSTRUCTOR IN ELECTRICAL ENGINEERING in fully accredited midwestern A & M college. Continued appointment for right man. Full particulars and minimum salary requirements in first communication. P-959, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

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EXECUTIVES AND TECHNICAL MEN. Qualified candidate desiring $2,500 to $20,000 position may contact employers through our confidential services, established 26 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

ELECTRICAL ENGINEER—Superintendent—43—Diverisified experience in all phases of Utility Operations, design and Construction, Power Plants, Substations Transmission and distribution. Familiar with budgets, accounting procedure, public relations and employee relations. Now employed. Desire change in location. Rocky Mountain or MidWest preferred. PW-956, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

(Continued on the opposite page)